PROCESSES OF CULTURAL DIVERSIFICATION IN THE EVOLUTION OF IRANIAN TRIBAL CRAFT TRADITIONS

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ABSTRACT

Debate regarding processes of cultural diversification has focused on the extent to which cultural assemblages are generated by ancestral entities branching into new ones (phylogenesis), or by borrowing and blending between contemporaneous entities (ethnogenesis). This case study addresses the relative contributions of both processes to Iranian tribal craft assemblages using biological phylogenetic methods and ethnographic data on the cultural transmission of weaving skills and designs. Analyses of a sample of textile traits associated with nine Iranian tribal populations suggests that both phylogenesis and ethnogenesis have influenced the evolution of their craft traditions: although the majority of resemblances among the assemblages are consistent with a hierarchical, tree-like pattern of descent, the strength of the conflicting signal indicates that a significant number of resemblances arose through other processes. This mixed pattern was investigated in relation to two hypotheses, both of which concern the structure of cultural assemblages. The first hypothesis proposes the existence of a set of 'core traditions' that evolve through branching, while other, 'peripheral' traits are borrowed and blended. The second hypothesis claims that rather than being constituted by a single core, cultural assemblages comprise 'multiple packages' of traits inherited from different sources. Although both hypotheses are supported to some extent, detailed examination of trait distribution patterns suggests that, rather than conforming to any single model, individual assemblages were generated by different cultural evolutionary processes. These are explored in relation to the history of a single design tradition – the 'Persian Garden Carpet' – in two groups of assemblages. Analyses of Garden Carpet designs used by different Turkmen tribes indicates that, among these groups, the tradition evolved mostly by descent from ancestral assemblages. In contrast, analyses of Garden Carpets woven by Bakhtiari populations indicates that they frequently shared and exchanged designs. The diversification of this tradition among both groups can be accounted for by the specific social and economic conditions of craft production in each case. It can therefore be concluded that processes of cultural diversification are determined by locally and historically specific factors that resist broad generalisation, even within the reasonably well defined regional context of this case study.

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CHAPTER 1

Background

1.1 Conceptual Foundations

Issues relating to the evolution of cultural diversity, and the extent to which it is comparable to biological evolution, have long interested researchers in the human and life sciences. For example, Darwin drew explicit analogies between the processes that generate variation among biological populations and those that influence cultural change, particularly in regard to language (Darwin 1859; Mesoudi et al. 2004). During the late 19th and early 20th centuries, evolutionary theories concerning the origins of racial, linguistic and cultural differences among humans were highly influential in anthropology (e.g. Tylor 1871; Spencer 1876; Morgan 1877; Kroeber & Kluckohn 1952), although many were based on naïve or misleading interpretations of Darwinism that have since been discredited (e.g. Stocking 1968; Kuper 1983). In recent years, evolutionary approaches to the study of cultural variation have been reinvigorated by a burgeoning theoretical literature (e.g. Boyd and Richerson 1985, 1996; Boyd et al. 1997; Dunnell 1989; Durham 1990, 1991, 1992; Dawkins 1976; Rosenberg 1994; Bellwood 1996; Lyman & O'Brien 1998; Aunger 2000; Shennan 2002; Mesoudi et al. 2004), and the application of new methods derived from evolutionary biology to cultural data sets (e.g. Foley 1987; Foley and Lahr 2003; Neiman 1995; Holden and Mace 1997, 1999; Sellen & Mace 1997, 1999; Mace & Holden 1999; Collard & Shennan 2000; Gray & Jordan 2000; Holden 2002; O'Brien et al., 2001, 2002, 2003; Shennan 2001, 2002; Shennan & Wilkinson 2001; Tehrani & Collard 2002; Jordan & Shennan 2003).

These studies have focused on a broad range of issues, including the relative contributions of 'descent with modification' and reticulation in generating linguistic and cultural diversity (e.g. Gray & Jordan 2000; Collard & Shennan 2000; O'Brien et al. 2001, 2002; Tehrani

& Collard 2001; Holden 2002; Jordan & Shennan 2003), the impact of selection and drift on cultural change (e.g. Neiman 1995; Shennan & Wilkinson 2001; Shennan 2001), and the co-evolution of biological characteristics and cultural practices (e.g. Mace and Pagel 1994; Holden and Mace 1997, 1999; Sellen and Mace 1997). Other researchers have attempted to link patterns in the ethnographic and archaeological records to linguistic and genetic data (e.g. Chakraborty et al. 1976; Cavalli-Sforza and Feldman 1981; Lumsden and Wilson 1981; Ammerman and Cavalli-Sforza 1984; Moore 1994, 2001; Kirch and Green 2000; Renfrew 1987; Bateman et al. 1990; Durham 1991; Zvelebil 1995; Shennan 2000; Whaley 2001; Bellwood 2001).

The emergence of what Durham calls 'Evolutionary Culture Theory' (*ECT*) represents a bold, and to many, controversial, attempt to integrate these diverse research agendas within a single, unified theoretical framework (Durham 1990, 1992; Rosenberg 1994; Shennan 2002; Moore 1994, 2001; Terrell 1988, 2001; Terrell et al. 1997). According to Durham's (1990) original formulation, *ECT* is based on three inter-connected propositions: firstly, that culture represents a second system of inheritance that is separate from genes, but evolves according to similar Darwinian principles; secondly, that variations among the cultural systems can be described by a hierarchical, branching pattern of descent; and lastly, that cultural diversity results from basic phylogenetic processes that are directly analogous to biological speciation.

The first of these propositions is derived from the theory of 'dual inheritance', (e.g. Boyd & Richerson 1985, 1996; Richerson & Boyd 1992; Durham 1990, 1992; Rosenberg 1994; Shennan 2000, 2002; Runciman 2002). Briefly, dual inheritance theory proposes a definition of culture that is based on a specific mechanism of transmission, namely 'social learning', whereby individuals acquire behaviours, skills or beliefs by imitating or emulating other individuals rather than through independent trial-and-error learning (Boyd & Richerson 1985, 1993; Richerson & Boyd 1992). Since social learning allows individuals to adopt behaviours exhibited by non-kin, dual inheritance theorists argue that the inheritance and modification of cultural traits are not necessarily correlated with, nor reducible to, genetic transmission. The theory is thereby distinct from other approaches, such as 'evolutionary archaeology', in which cultural artefacts are regarded as extensions of the human phenotype (e.g. Dunnell 1978, 1980, 1989; Braun 1983, 1990; Rindos 1984, 1989; Leonard and Jones 1987; O'Brien and Holland 1990, 1992, 1995; Neff, 1992, 2000; Telster, 1995; O'Brien 1996; Lyman and O'Brien, 1998; O'Brien et al. 1998; O'Brien and Lyman 2000; Leonard 2001). Evolutionary archaeologists contend that artefact variation in the archaeological record should therefore be explained in exactly the same way as palaeobiologists explain variations in bony morphology in the fossil record, namely as a result of natural selection and drift (Lyman and O'Brien 1998, Collard and Shennan – in press). However, although supporters of dual inheritance theory recognise that the replicative success of many cultural traits may well be influenced by their impact on genetic fitness (Boyd & Richerson 1985, 1996; Durham 1991), there is convincing evidence that cultural evolution often occurs too quickly for natural selection to be the only process involved in cultural change (e.g. Mithen, 1997; Boone and Smith, 1998; Runciman, 2002). For example, the adoption of snowmobiles as the favoured form of hunting transportation among the Cree of northern Canada, and the replacement of audio cassettes by compact discs in western Europe and the United States since the 1970s cannot be explained in terms of differential reproductive success because these changes occurred in less than a generation (Shennan 2002; Collard and Shennan – in press).

According to dual inheritance theory, both these examples epitomise a process of cultural transmission known as *direct bias*, whereby individuals deliberately select traits that enable them to maximise their chances of success in performing specific tasks. These may involve attracting potential mates, obtaining food or other resources, or, in the latter example, accessing and copying music collections more efficiently (Boyd and Richerson 1985, 1992; Shennan 2002; Mesoudi et al. 2004). This form of *cultural selection* (Cavalli-Sforza and Feldman 1981; Rosenberg 1994; Mesoudi et al. 2004) enables useful behaviours to circulate among a population of social learners far more rapidly than is possible through natural selection. It has also been suggested, *contra* evolutionary archaeology, that, in some cases, cultural traits may propagate or persist even when they are maladaptive from a genetic point of view (e.g. Boyd and Richerson 1985; Richerson and Boyd 1992; Shennan 2002). For example, many people continue to acquire the habit of smoking despite its well-publicised deleterious effects on individual fertility and longevity. Dual inheritance theorists have suggested that the accumulation of such traits might be explained by another process of cultural transmission called *indirect bias*, whereby individuals copy all or many of the attributes associated with successful individuals indiscriminately (Boyd and Richerson 1985, 1993; Richerson and Boyd 1992; Shennan 2002). This process is particularly likely to occur when the specific cultural criteria that define success are ambiguous or even conflict with those associated with maximising reproductive fitness. An extreme example of the latter is provided by the Shakers of the United States, whose religious beliefs prohibit sexual intercourse (Shennan 2002). However, the rapidly declining population of Shakers indicates that the proliferation of culturally-selected traits with negative fitness consequences are inevitably constrained by natural selection in the long-term.

Several recent studies of chimpanzee (Whiten et al. 1999, 2001, 2003) and orang-utan behaviour (van Schaik et al. 2003) suggest that the concept of culture as a unique attribute of our species should be modified, since the capability for social learning is not exclusive to modern humans. However, the unique spatial and temporal variation of socially-transmitted traits among human populations, which far exceeds that of out closest relatives, provides the richest source of data for investigating the extent to which culture is shaped by Darwinian processes of inheritance (Boyd & Richerson 1996; Shennan 2002; Mesoudi et al. 2004). In a recent review of the field, Mesoudi and colleagues (Mesoudi et al. 2004) evaluated how well this claim was supported by evidence collected from a wide range of sources, including the history of science and technological advances in western societies (Basalla 1988; Dunbar 1995, 1997; Simonton 1995), linguistic change (Krauss 1992; McGeoch & MacDonald; Gray & Jordan 2000) and subsistence methods (Ryan & Gross 1943; McGovern 1981; Mace & Pagel 1994). They also looked at consumer preferences in toys (Hinde & Barden 1985), the transmission of tool-making skills

(O'Brien & Lyman 2000; Cavalli-Sforza & Feldman 1981), and social organisation (Guglielmino et al. 1995; Hewlett et al. 2002). Mesoudi et al. (2004) concluded that human cultural evolution exhibits many of the properties that Darwin identified in *The Origin of Species* (1859): in particular, variation, competition, inheritance and the accumulation of modifications over time. As the authors point out, the operation of these processes can be identified independently from the actual units of cultural inheritance and replication, since Darwin's arguments did not depend on discoveries in genetics that were made long after his theories were published. Consequently, the validity of dual inheritance theory is neither dependent on cultural analogues for genes, such as 'memes' (Dawkins 1976) or 'semes' (Hewlett et al. 2002), nor undermined by criticisms relating to these concepts (e.g. Lake 1998; Bloch 2000; Sperber 2000).

The two other central tenets of *ECT*, however, have proved to be far more controversial. Whereas few of the criticisms aimed at Darwinian theories of cultural evolution relate specifically to dual inheritance theory, the use of phylogenetic models and techniques to reveal patterns of cultural diversification has attracted considerable comment and opposition (e.g. Terrell 1988, 2001; Durham 1990, 1992; Dewar 1995; Bellwood 1996; Welsch et al. 1996; Boyd et al. 1997; Mace and Pagel 1997; Rogers and Cashdan 1997; Terrell et al. 1997; Moore 1994, 2001; Borgerhoff Mulder 2001; Shennan 2002; O'Brien et al. 2002; O'Brien and Lyman 2003). The remainder of this chapter will focus on the major issues arising from this discussion and the empirical research that has addressed them.

1.2 The Phylogenesis – Ethnogenesis Debate

Recent debate regarding processes of cultural diversification – to which this thesis aims to contribute – has focused on two competing hypotheses that have been termed 'phylogenesis' and 'ethnogenesis' (Moore, 1994, 2001; Collard and Shennan, 2000; Tehrani and Collard, 2002). The phylogenesis hypothesis incorporates all three principles of Evolutionary Culture Theory (*ECT*) (Durham 1990, 1992): Building on the claim that cultural evolution is governed by the same Darwinian principles as biological evolution, proponents of the phylogenesis hypothesis (e.g. Durham 1990, 1992; O'Brien et al. 2001, 2002; O'Brien and Lyman 2003) argue that processes of cultural diversification are likely to be analogous to those responsible for biological speciation. Thus, according to this hypothesis, new cultural entities arise primarily through descent with modification from an ancestral social group or 'cultural prototype' (Durham 1990, 1992, Kirch and Green 1987, 2001; O'Brien and Lyman 2003). Relationships between cultural entities related by descent from a common ancestral assemblage can be represented by a 'family tree', 'cladogram' or 'dendrogram' (Boyd et al. 1997; Terrell 2001; Collard and Shennan 2000; O'Brien and Lyman 2003).

In *ECT*, the progressive subdivision of cultural assemblages into descendent entities is associated with demographic processes in which populations split and give rise to new ones (e.g. Durham 1990, 1992; Collard and Shennan 2000; Tehrani and Collard 2002). Thus, related populations are linked by a number of cultural traits that they inherited from an ancestral population. Furthermore, Durham (1992) has argued that the ethnographic record provides some evidence that there may be a number of effective barriers to 'hybridisation' or 'multi-parental' inheritance, which he labels 'Transmission Isolating Mechanisms', or TRIMS. The role of TRIMS in generating cultural phylogenesis is analogous to that of reproductive isolating mechanisms in biological speciation. Potential examples of TRIMS include language differences, ethnocentricism, mutual hostility/warfare (Durham 1990; 1992; Boyd et al. 1997; Shennan 2002), and psycho-social mechanisms that constrain the growth of co-operative groups (e.g. Cox et al. 1999; Dunbar 1993) and discourage co-operation with members of other groups (e.g. Gil-White 2001; Nettle 1999).

The assumptions of the phylogenesis model have been challenged by a number of researchers (e.g. Moore 1994, 2001; Terrell 1988, 2001; Terrell et al. 1997; Welsch et al. 1996; Rogers and Cashdan 1997). Firstly, the notion that daughter populations are more culturally similar to their parent population than they are to 'unrelated' contemporaneous populations has been criticised as 'primordialist' by authors such as Terrell (1988, 2001), Welsch and colleagues (1997) and Moore (1984a, 1994b, 2001). These authors argue that the phylogenesis hypothesis overstates the cultural homogeneity of 'traditional' societies, whose ethnic, linguistic and genetic integrity is misrepresented as being historically continuous. Instead, they emphasise the social and cultural heterogeneity of small-scale societies, and the extent to which ethnic boundaries are fluid and contextually defined, rather than intrinsically determined. The second criticism relates to the fact that social learning enables individuals to adopt behaviours from non-kin and possibly also from members of other social groups. Consequently, the potential for cultural traits to be transferred laterally between populations, combined with the relatively rapid rate of cultural evolution compared to biological evolution, greatly limits the likelihood of identifying long-lasting units of inheritance on which to base a cultural phylogeny (e.g. Moore 1984; Borgenhoff Mulder 2001). Thirdly, the analogy with biological speciation has been challenged on the grounds that, whereas related species share a common genetic history, the cultural traditions associated with any given population cannot be assumed to be all descended from a single common ancestor (Boyd et al. 1997; Moore 1994, 2001; Borgenhoff Mulder 2001; Terrell 1988, 2001). According to the critics of ECT, a tree structure similar to those used by evolutionary biologists cannot represent the heterogeneous pattern of inheritance they believe is associated with culture.

Similar criticisms have been made of the use of phylogenetic comparative methods to test hypotheses of adaptation and the co-evolution of cultural practices in cross-cultural correlation analyses (e.g. Mace and Pagel 1994, 1997; Holden and Mace 1997, 1999; Mace and Holden 1999; Sellen and Mace 1997, 1999; Rogers and Cashdan 1997; Borgerhoff Mulder 2001). These methods were introduced to anthropology to overcome the problem of historical relatedness among populations included in cross-cultural samples (Mace and Pagel 1994). Since correlation analysis requires cases to be independent from one another, it is crucial to discount instances where the occurrence of particular traits among a group of populations might have arisen through common ancestry rather than through independent or convergent evolution.

Therefore, a number of researchers have used language and genetic phylogenies to control for the complicating effects of historical relatedness on cross-cultural datasets to investigate issues relating to the adoption of camel herding among African pastoralist populations (Mace and Pagel 1994), the evolution of post-infancy high lactose digestion capacity (Holden and Mace 1997), the development of matrilineal social organisation in sub-Saharan Africa (Mace and Holden 1999) and several other long-standing anthropological hypotheses (e.g. Holden and Mace 1999; Sellen and Mace 1997, 1999). However, critics of this approach have questioned whether linguistic phylogenies are useful indicators of patterns of cultural inheritance, since individuals or groups might acquire cultural and linguistic traits from different sources (Rogers and Cashdan 1997; Cashdan and Rogers 1997; Borgerhoff Mulder 2001). This echoes the charge that proponents of the phylogenesis hypothesis over-estimate the cultural, linguistic and genetic homogeneity of populations (e.g. Moore 1994; Terrell et al. 1997; Terrell 2001). More generally, the assumption that a branching phylogeny represents an accurate model of population/cultural histories has been challenged on the grounds that cultural traits, aspects of language and genes can also be exchanged between contemporaneous groups (Borgerhoff Mulder 2001). This undermines one of the main purported advantages of phylogenetic comparative methods over other approaches to correlation analysis, such as those based on stratified sampling (e.g. Murdock and White 1969). The latter attempts to circumvent the problem of historical relatedness by clustering populations into groups that are deemed to be independent of one another, and then selecting a representative population from each group for inclusion in the analysis. One of the problems with this approach is that, without phylogenetic controls, it is not possible to investigate hypotheses of adaptation or co-evolution within a single region, since populations within a region are likely to be more closely related to one another than populations from different regions (Mace and Pagel 1994, 1997). However, critics of phylogenetic comparative methods point out that, although neighbouring populations are more likely to be related to one another than more distant ones, cultural exchanges between contemporaneous groups are also more likely to occur within localised areas (Borgerhoff Mulder 2001). Consequently, similarities that do not correlate with the linguistic phylogeny should not be assumed to have resulted from independent invention or convergence, since they may have resulted from cultural transmission between linguistically unrelated, but neighbouring societies. Therefore, a language phylogeny represents an insufficient control for distinguishing between cultural transmission and independent evolution (Borgerhoff Mulder 2001; Rogers and Cashdan 1997).

Critics of the 'branching' model of cultural evolution have proposed an alternative model based instead on 'blending'. This model is referred to by Moore (1994, 2001) as the 'ethnogenesis hypothesis', which emphasises processes of recombination, admixture and diffusion among the cultural traditions associated with different populations (Moore 1994, 2001). Supporters of the ethnogenesis hypothesis claim that human societies have never developed in isolation, but through "a constant flow of people, and hence their genes, language, and culture, across the fuzzy boundaries of tribes and nations, spreading within a region... within a few generations, and across the continent in a few more" (Moore 2001: 51). Thus, Terrell and colleagues (Terrell 1988, 2001; Terrell et al. 1997; Welsch et al. 1996) criticise the traditional view of Polynesian societies as having evolved through the colonisation of separate islands and the subsequent isolation of founding populations (e.g. Kirch and Green 1987). Instead, they argue that Polynesian cultural assemblages provide extensive evidence of trade, exchange and diffusion. Moore (1994, 2001) also emphasises the instability of human populations over long periods of time and the importance of genetic admixture in providing the 'raw materials' for new, hybrid cultures. Processes of cultural transmission influenced by such mechanisms as trade, exchange, bi-lingualism and inter-marriage are therefore analogous to gene-flow *within* a species, which can be more accurately represented by a 'matrix' or 'reticulated graph' than by a phylogentic tree (Terrell 2001). In this model, patterns of cultural diversity are likened to an 'entangled bank' (Terrell 1988) or 'braided river bed' (Moore 1994a), in which separate cultural traditions are blended and intertwined, temporarily knotting together and unravelling again as they pass through history.

In recent years, a number of researchers (e.g. Boyd et al. 1997; Collard and Shennan 2000; Bellwood 1996; Shennan 2002; Tehrani and Collard 2002) have expressed doubts about whether ethnogenesis is as dominant a process of cultural diversification as its supporters claim. They argue that the archaeological record provides substantial evidence of long-lasting and coherent artefact traditions, even when the populations that produced them were not isolated from other societies (e.g. Petrequin 1993; Shennan 2002; Shennan and Wilkinson 2001; Collard and Shennan – in press). Shennan and Steele's (1999) survey of ethnographic descriptions of craft transmission in non-industrialised societies revealed that, in the vast majority of cases, children acquired craft skills from elders of the same social group, usually a parent of the same sex. Several other, more localised, studies of cultural transmission conformed to this pattern (e.g. Hewlett and Cavalli-Sforza 1986; Greenfield et al. 2000; Aunger 2000; Tehrani and Collard 2002). Linguistic evidence also contradicts the assertions of proponents of the ethnogenesis hypothesis, since the rarity of pidgin and creole languages indicates that languages are usually inherited from single 'parental' populations, rather than from multiple sources (e.g. Durham 1992; Boyd et al 1994; Bellwood 1996). In view of this archaeological, ethnographic and linguistic evidence, several writers (e.g. Kirch and Green 1987; Bellwood 1996; Collard and Shennan 2000) have suggested that, rather than rejecting either the phylogenesis or ethnogenesis hypothesis *a priori*, the relative importance of phylogenetic and reticulate processes to cultural diversification should be assessed on a case-by-case basis.

1.3 Empirical Research

Early assessments regarding the respective merits of the phylogenesis and ethnogenesis hypotheses were largely based on qualitative evidence (e.g. Terrell 1988; Durham 1990, 1992; Moore 1994; Bellwood 1996; Boyd et al. 1997). However, in recent years, an increasing number of studies have aimed to make an empirical contribution to the phylogenesis/ethnogenesis debate. These investigations have focused on the influences of branching and blending processes on the evolution of languages (Gray and Jordan 2000; Holden 2002), material culture assemblages (Welsch et al. 1992; Moore and Romney 1994; Moore and Romney 1996; Collard and Shennan 2000; Jordan and Shennan 2003; Collard and Shennan 2001; Tehrani and Collard 2002), subsistence skills, religious beliefs and aspects of social organisation (Guglielmino et al. 1995; Borgerhoff Mulder 2001; Hewlett et al. 2002).

Two studies have investigated the roles of phylogenetic and reticulate processes in linguistic evolution (Gray and Jordan 2000; Holden 2002). Gray and Jordan (2000) tested two competing hypotheses of Pacific prehistory using phylogenetic techniques (specifically, 'maximum parsimony analysis') to reconstruct the evolutionary relationships among Austronesian languages. The first hypothesis proposes an 'express train' sequence of colonisation and expansion, whereby the rapid spread of Austronesian languages are linked to the movements of successive founder populations descended from a common ancestral group believed to have originated in Taiwan some 6,000 years B.P. (before present). According to this hypothesis, contact between the descendents of founder populations in Polynesia made a negligible contribution to cultural and linguistic patterns in the region, which can be best explained by a hierarchical, tree-like pattern of descent. In contrast, the second hypothesis proposes a Melanesian origin for Polynesian islanders, whose cultural and linguistic relationships can be better explained by an 'entangled bank' model of continuous contact and exchange. Gray and Jordan (2000) assessed the relative merits of these models by first generating a linguistic phylogeny and then comparing it to archaeological evidence and geographical data. The results of their analyses indicated that the links between the archaeological and geographical steps fitted the express train model far more closely than would be expected to occur by chance. Although Gray and Jordan (2000) accept that some discrepancies probably resulted from borrowing and blending between neighbouring groups following the initial colonisation of the islands, their results did not support the contention that processes of combination and recombination were more important than descent. Were this the case, then proximity on the language phylogeny would have been expected to be more closely correlated with geographical proximity, and not fit as neatly with the groups' population histories.

Holden (2002) has employed methods similar to those used by Gray and Jordan (2000) to investigate an analogous problem in the history of African Bantu languages. Some researchers have argued that Bantu languages spread rapidly in conjunction with the expansion of farming in sub-Saharan Africa during the Neolithic and Iron Age. As with the 'express train' model in the Pacific, relationships among Bantu and Bantoid languages can therefore be described by a phylogenetic tree, representing the descent of each population of language-speakers. However, other researchers contend that this model fails to account for likely instances of borrowings between neighbouring communities, and it thus probably flawed. Holden (2002) addressed these issues in a phylogenetic 'maximum parsimony' analysis of 92 items of basic vocabulary in 75 Bantu and Bantoid languages. The results of this analysis suggested that the distributions of most linguistic traits could be explained by a relatively small number of phylogenetic models, which, although not entirely consistent with one another, largely supported the tree model of Bantu language evolution. Further investigation revealed that the language trees were broadly consistent with an archaeological model for the spread of farming in Sub-Saharan Africa which is based on the distributions of pottery styles and dates. These results thus supported the hypothesis that the diversification of the Bantu languages was linked to the expansion of farming during the Neolithic and Iron Age, with relatively little borrowing and blending subsequent to this period (Holden 2002).

While both Gray and Jordan's (2000) and Holden's (2002) studies suggest that languages evolve in a largely tree-like way, and are therefore compatible with the phylogenesis hypothesis, the results of various investigations into the diversification of material culture traditions are more ambiguous. Several of the latter studies have focused on variation in the material culture assemblages associated with villages on the North Coast of New Guinea (Welsch et al. 1992, Moore and Romney 1994, Moore and Romney 1996, Welsch 1996, Collard and Shennan, 2001). Using regression and correspondence analysis of the presence/absence of cultural artefacts produced by societies in this region, Welsch and colleagues found that the similarities and differences among the village assemblages are strongly associated with geographic propinquity, and unrelated to the linguistic relations of the villages (Welsch et al. 1992, Welsch 1996). Since cultural relationships between the populations included in their analyses appear to be determined by their geographical distributions, Welsch and colleagues (Welsch et al. 1992, Welsch 1996) concluded that borrowing and blending were more important cultural evolutionary processes in the North Coast of New Guinea than descent from ancestral populations, since the latter would be expected to produce a stronger correlation with linguistic patterns. However, in a separate study, correspondence and hierarchical log-linear analyses of this data, in which the occurrence of artefacts was encoded on a frequency basis, rather than on a presence/absence basis, Moore and colleagues (Moore and Romney 1994, 1996, Roberts et al. 1995) found that geography and language have equally strong effects on material culture variation on the North Coast of New Guinea. Most recently, Collard and Shennan (2001) carried out a re-analysis of Welsch and colleagues' presence/absence data set using the mantel test and three methods from biological phylogenetics: parsimony analysis, optimisation analysis and relative apparent synapomorphy analysis. The results of these analyses indicated that although the populations' linguistic relationships were not entirely consistent with similarities among their material culture assemblages, they were a better predictor of material culture variation than the groups' geographical distributions. Consequently, although there is strong evidence of both phylogenesis and ethnogenesis in the evolution of material culture assemblages in New Guinea, two of the three groups of studies (i.e. Moore and Romney 1994, 1996, Roberts et al. 1995; Collard and

Shennan 2001) that have been summarised here suggest that the former was at least as important, if not more so, than the latter.

Three other studies have focused on the diversification of material culture traditions among continental populations (Collard and Shennan 2000; Tehrani and Collard 2001; Jordan and Shennan 2003), which are generally assumed to be more influenced by ethnogenetic processes than those associated with more isolated island populations (Bellwood 1996). The first study concerned the evolution of decorative pottery styles from Neolithic settlements in the Merzbach Valley, Germany (Collard and Shennan 2000). Collard and Shennan (2000) used cladistic techniques of phylogenetic reconstruction to assess whether the temporal and spatial variation of pottery designs could be better accounted for by the phylogenesis hypothesis or ethnogenesis hypothesis. The first set of analyses investigated whether the pottery assemblages associated with the four settlements which were occupied throughout the 10-phase period from which data were sampled divided into the same groups in each phase or into different groups in consecutive phases. In six instances where consecutive phases could be compared, the results of the analyses indicated that pottery styles were generated by descent from ancestral assemblages, since the assemblages were divided into the same groups. However, in three instances, the assemblages were divided into different groups in consecutive phases, suggesting that they were influenced by borrowing and blending. Overall, these results suggest that the Merzbach pottery assemblages were generated by both phylogenesis and ethnogenesis, although the former was the dominant process. The second analysis focused on the three instances in the 10-phase period in which a new pottery assemblage appears. The results of thise analysis indicated that two of these new assemblages were derived from a single 'parent' assemblage from previous phases, and were therefore generated by phylogenesis. The third assemblage also appears to have been largely generated by phylogenesis, although ethnogenetic processes are more evident than in the other two cases. Therefore, the results of the second set of analyses concurred with the results of the first set of analyses, suggesting that the evolution of Neolithic decorative pottery styles in the Merzbach Valley was more influenced by branching processes than blending processes (Collard and Shennan 2000).

Tehrani and Collard (2002) carried out a similar study of craft evolution in which they applied cladistic methods to data sampled from hand-knotted carpets and woven bags produced by five nomadic-pastoralist Turkmen populations in north-eastern Iran, Turkmenistan and Afghanistan between the 18th and early 20th centuries. The results of their analyses suggested that, as in the Merzbach pottery case, phylogenesis and ethnogenesis both contributed to the diversification of Turkmen textile designs, although the former was by far the more important process. Using two techniques for measuring how well patterns within a given data set fit a bifurcating tree model (namely, the Consistency Index and bootstrapping), Tehrani and Collard calculated that approximately 70% of resemblances between the assemblages are likely to have been inherited from common ancestral assemblages. The remaining 30% of resemblances between the designs used by each group resulted either through independent invention, or more likely, through ethnogenesis. Although the craft phylogeny obtained from the textile designs data did not match ethnohistorical accounts relating to the tribes' population histories, ethnographic research suggests that there is reason to believe that the latter may be inaccurate, whereas the phylogeny is supported by other evidence relating to the groups' clan names, dialects and their geographical distributions (Tehrani and Collard 2002). A second analysis included textiles produced after the Russian colonisation. The results of this analysis suggested that, although phylogenesis continued to dominate the evolution of Turkmen woven, the contribution of ethnogenetic blending processes increased from 30% in the preceding period to 40% following the Russian conquest. Tehrani and Collard speculate that this shift might be accounted for by social and economic changes which occurred during this period: whereas, in the past, weavers from different groups were relatively isolated from one another by institutions such as endogamous marriage-practices and particularly by inter-tribal warfare, the pacification of the Turkmen removed a potentially important Transmission Isolating Mechanism, while the commercialisation of textile production probably introduced new incentives to copy designs from external sources (Tehrani and Collard 2002).

Ethnogenesis appears to have played a much more important role in the history of basket-making among indigenous populations in California (Jordan and Shennan 2003). Jordan and Shennan used a variety of phylogenetic techniques to investigate the relative contributions of branching and blending to Californian basketry assemblages. The first of these, the permutation tail probability (PTP) test, assessed whether or not their basketry data-sets contain a phylogenetic signal. The results of the PTP test suggested that a significant phylogenetic signal was present in all three datasets. However, according to the results of a subsequent test, the Consistency Index, the fit between the datasets and a bifurcating tree model was weak. In the third set of analyses, Jordan and Shennan used a further statistical test developed by Kishino and Hasegawa (1989) to assess the fit between the datasets and trees reflecting linguistic relationships, geographic distance, adjacency and ecological similarity. In the analysis of the complete sample of baskets, the fit between the dataset and the adjacency tree was considerably better than the fit between the dataset and the other trees. This suggests that ethnogenesis had a bigger impact on the distribution of similarities and differences among the basketry assemblages than phylogenesis or adaptation to local environments. In an analysis of the coiled baskets, ethnogenesis was found to play an even more significant role than phylogenesis or adaptation to local environments. An analysis of the twined baskets contrasted with the preceding analyses in that the language tree fitted the dataset better than the other trees. This suggests that phylogenesis was more important in generating the twined baskets than ethnogenesis or adaptation to local environments. Nevertheless, taken together, the results of Jordan and Shennan's analyses suggest that, in contrast to the Merzbach (Collard and Shennan 2000) and Turkmen (Tehrani and Collard 2002) studies, ethnogenetic blending was the dominant process of cultural evolution in Californian basketry (Jordan and Shennan 2003).

Three other studies have assessed the significance of phylogenesis and ethnogenesis as cultural evolutionary processes (Guglielmino et al. 1995; Hewlett et al. 2002; Borgerhoff Mulder 2001). These have focused on the transmission of a wide variety of traits in African societies, most of which related to aspects of social organisation (such as gender relations, marriage patterns and property inheritance etc.) but also included habitat types and political and religious values. In the first study, Guglielmino and colleagues investigated the roles of inheritance, diffusion and adaptation in relation to 47 cultural traits distributed among 277 African societies (Guglielmino et al. 1995). Models of the three processes were generated, and then correlation analyses undertaken in which language was used as a proxy for phylogenesis, geographic distance was used as a measure for ethnogenesis, and vegetation type was used as a proxy for adaptation. These analyses found that most of the traits relating to social organisation best fit the phylogenesis model. The distributions of only a few of the remaining traits were explicable in terms of adaptation and only a minority of traits supported the ethnogenesis model. Similar results were obtained by Helwett and colleagues' study of cultural traits shared among 36 African populations (Hewlett et al. 2002). They found that adaptation made a negligible contribution to cultural similarities between the populations from which data were sampled. A number of traits, particularly those relating to sexual taboos and habitat types were correlated with geographical proximity and are therefore likely to have been transmitted between neighbouring societies. However, the majority of traits, especially those relating to kinship and political organisation, were closely correlated with the groups' linguistic relationships, suggesting that they were largely inherited from ancestral populations (Hewlett et al. 2002).

In the third study of cultural evolution in Africa, Borgerhoff Mulder examined correlations between traits associated with kinship and marriage patterns in 35 East African societies (Borgerhoff Mulder 2001). The results of this study were more equivocal: An analysis of phylogenetically controlled data (in which traits were mapped onto a language phylogeny) supported roughly half the number of statistically significant correlations returned by an analysis of phylogenetically uncorrected data. These results failed to support the author's original hypothesis that adaptation to local environments plus diffusion between neighbouring populations would erase any phylogenetic signature from the data. Were that the case, then the correlations between different traits in the phylogenetically controlled analysis would have returned very similar results to a conventional statistical analysis of the raw data. However, nor do these results lend unqualified support to the phylogenesis hypothesis. The high proportion of correlations that remain unaffected by phylogenetic correction is at least partially consistent with ethnographic and historical depictions of extensive mixing and merging between cultural groups in East Africa over the last three millennia (Borgerhoff Mulder 2001:101). Nevertheless, this view would seem to require substantial revisions to account for the role of inheritance in generating patterns of cultural diversity in Africa, strong evidence of which is provided by the analyses carried out by Borgerhoff Mulder (2001), Guglielmino, Hewlett and colleagues (Guglielmino et al. 1995; Hewlett et al. 2002).

Taken together, the results of the case studies summarised above support the view that the relative contributions of branching and blending to cultural evolution should be assessed on a case-by-case basis (e.g. Bellwood 1996; Kirch and Green 1987; Collard and Shennan 2000). Phylogenesis dominated the evolution of Polynesian and Bantu languages (Gray and Jordan 2000; Holden 2002) and largely accounts for patterns of cultural diversity in Neolithic pottery assemblages in the Merzbach valley (Colllard and Shennan 2000) and Turkmen textile designs (Tehrani and Collard 2002). Only the study of Californian basketry traditions (Jordan and Shennan 2003) supports the assertion that ethnogenesis should be regarded as the dominant cultural evolutionary process (e.g. Moore 1994, 2001; Terrell 1988, 2001; Terrell et al. 1997). Evidence of both phylogenesis and ethnogenesis was present in the New Guinea material culture data (Welsch et al. 1992, Moore and Romney 1994, Moore and Romney 1996, Welsch 1996, Collard and Shennan, 2001) and distributions of cultural similarities among African societies (Guglielmino et al. 1995; Hewlett et al. 2002; Borgerhoff Mulder 2001). Two of the latter studies (Guglielmino et al. 1995; Hewlett et al. 2002) indicated that inheritance from ancestral populations was a more significant process than diffusion between neighbouring groups, while phylogenesis appears to have been at least as important as ethnogenesis in generating variation in East African kinship and marriage practices (Borgerhoff Mulder 2001) and cultural artefacts produced on the north coast of New Guinea (Moore and Romney 1994, Moore and Romney 1996, Collard and Shennan 2001).

Secondly, it should be noted that the contrasting results of these case studies are only quantitatively different from one another: Even in cases where one process is dominant, it is not absolute. Thus, although relationships between Polynesian languages fit a tree model reasonably well, Gray and Jordan point out that there is also some evidence of word borrowings between speech communities following the initial population splits that probably gave rise to them (Gray and Jordan 2000). Holden (2002), Collard and Shennan (2000), and Tehrani and Collard (2002) make similar observations regarding the diversification of Bantu languages, Merzbach pottery styles and Turkmen textile designs respectively, even though each of these traditions evolved in a largely tree-like manner. The general processes of development that influenced Californian basketry traditions, on the other hand, appear to be more compatible with the ethnogenesis hypothesis. However, Jordan and Shennan concluded that similarities between twined basketry techniques are likely to have been inherited, since they were more closely correlated with the populations' linguistic relationships than other traits. Studies of cultural variation in Africa also suggest that the evolutionary histories of different traits follow different paths: for example, while traits associated with kinship and social organisation seem to be largely inherited from ancestral groups, the geographical distributions of habitat types and religious beliefs suggest that these traits were frequently transmitted between neighbouring groups (Guglielmino et al. 1995; Hewlett et al. 2002). These studies therefore suggest that although the *relative* contributions of phylogenesis and ethnogenesis in generating cultural assemblages may vary from case to case, cultural transmission usually involves a combination of both branching and blending processes.

1.4 'Core Traditions' and 'Multiple Packages'

This summary of empirical assessments of the phylogenesis/ethnogenesis problem lends support to the view of some researchers (e.g. Boyd et al. 1997; Rosenberg 1994; Shennan 2002) that neither of the two hypotheses discussed so far offer a satisfactory explanation of processes of cultural diversification. Since both branching and blending are likely to be important cultural evolutionary processes, two further hypotheses have been proposed, each of which attempts to reconcile the opposing views represented in the phylogenesis/ethnogenesis debate. The first hypothesis proposes that cultures are constituted by 'hierarchically integrated systems', comprising 'core traditions' and 'peripheral elements'. The former arise through descent with modification and can exist over long periods of time, despite high rates of interaction between members of adjacent populations. In contrast, peripheral elements are more likely to be acquired through processes of diffusion and to change rapidly (Boyd et al. 1997; Rosenberg 1994; Shennan 2002). The second hypothesis proposes that, rather than comprising a single core, cultures might consist of 'many coherent units', or 'multiple packages' (ibid.). This model is closer to the ethnogenesis model in so far as it proposes that societies probably acquire cultural traits from neighbouring societies as well as from ancestral groups, thereby generating multiple patterns of inheritance which cannot be described by a single phylogeny. However, the model is distinct from the ethnogenesis hypothesis because it also proposes that many traits are acquired as integrated groups or 'packages', rather than as individual units of transmission and reticulation. Packages are believed to represent coherent and stable cultural traditions that probably originate through splitting processes. Thus, although phylogenetic models may not be appropriate representations of whole assemblages, they can be used to describe the descent and diversification of individual cultural traditions (Boyd et al. 1997; Shennan 2002).

Several examples from anthropological and archaeological literature have been cited in support of these two hypotheses. Rushforth and Chisholm's (1991) study of moral and social values associated with Athapaskan-speaking populations in North America has been used to illustrate the concept of 'core traditions' (e.g. Boyd et al. 1997; Shennan 2002). The linguistic and geographical distributions of behaviours associated with a specific and coherent framework of social discourse and interaction suggest that they originated in an ancestral population shared by all Athapaskan-speakers and have remained relatively stable through time. Boyd and colleagues (Boyd et al. 1997) suggest that the maintenance of this normative order, in which qualities such as industriousness, generosity and restraint are highly valued, might be explained as an Evolutionary Stable Strategy: individuals who behave in accordance with shared expectations regarding the purpose and form of social interaction are rewarded while those who do not are either punished or excluded (Boyd et al. 1997). Seen in these terms, the moral framework that governs social interactions among Athapaskan-speaking populations might be resistant to the incorporation of new values or behaviours, the potential benefits of which are outweighed by the costs of an individual's failure to conform. The evolutionary implications of this have been neatly expressed by Rosenberg, who states that "though they are clearly not static in the sense of unchanging, cultures will tend to stasis in their essential superstructural components [i.e. 'cores']. Cultures can change gradually by means of micro-evolutionary processes in directions left open by the existing (and evolving) system, but not gradually become other cultures.... Such an eventuality is possible only if a cultural system (or significant subsystems thereof) disintegrates" (Rosenberg 1994:333). Accordingly, Rosenberg argues that the diversification of core cultural systems is more likely to occur through punctuated evolution, rather than through the gradual accumulation of modifications, and are therefore likely to remain stable for long periods of time (Rosenberg 1994).

Ortman's (2000) study of textile and pottery imagery in the Mesa Verde region of the American Southwest during the Great Pueblo period (11th – 13th centuries) has also been cited as a possible example of how core traditions might evolve and persist (Shennan 2002; Shennan and Collard in press). Ortman demonstrates that potters in the Mesa Verde deliberately copied designs from woven textiles and baskets and very rarely experimented with novel patterns. Secondly, although the designs copied by potters were initially constrained by the specific craft techniques associated with weaving and basketry, they do not appear to have been substantially modified. Ortman argues that the lack of innovation in pottery designs can be accounted for by a broader symbolic association between pots, containers and the cosmos suggested by underground ritual chambers called *kivas*. *Kivas* were often decorated with designs similar to those used on pottery artefacts, while their roofs were constructed in a similar way to coiled baskets. In modern Pueblo societies, *kivas* are reportedly believed to represent the earth as a clay bowl and the sky as a basket (Ortman 2000). These observations suggest that pottery, textile and basketry designs were not transmitted individually, but as a part of a coherent cultural 'core' that was based on a specific set of religious beliefs and ritual practices (Shennan 2002). The latter can be interpreted in Rosenberg's (1994) terms as a cultural superstructure that constrained the selection and propagation of pottery designs in the Mesa Verde valley, as indicated by the rejection of new designs which did not fit the paradigm.

While the 'core and periphery' hypothesis assumes that long-lasting cultural traditions are only inherited by descent from ancestral populations, the 'multiple packages' model proposes that functional and symbolic inter-relationships between socially-learned traits can produce a number of distinct cultural lineages that may sometimes cut across genetic and linguistic distinctions. Boyd et al. (1997) cite several studies which support the existence of 'packages' in languages, ritual behaviours and aspects of social organisation. Among the examples they discuss is the spread of behaviours associated with the 'age-set system' in Eastern and Central Africa. In this system, adolescent males of similar age enter firstly into 'warrior class' through mass circumcision ceremonies, and are later initiated into higher age-sets as they grow older, assuming new roles as their social rank and responsibilities increase. Although the age-set system is likely to have been inherited by many of the Nilotic peoples who practice it, there is strong evidence that it has also been acquired by other populations as an independent unit of cultural inheritance separately from language and other customs. For example, ethnographic and historical data suggests that the Tiriki, who speak an Abaluhyia language belonging to the Bantu family, acquired a range of institutions, behaviours and values associated with the age-set system from the neighbouring, Nilotic-speaking Terik in the mid-18th century. These include the names of seven age-sets, initiation rituals involving male circumcision and seclusion, and an ideology of warrior bravery and prowess (Boyd et al. 1997). Since the Tiriki remain linguistically distinct from the Terik, and are known to have rejected other Teriki cultural practices (e.g. female circumcision), the similarities between both groups' age-set systems are not likely to have resulted from either inheritance from ancestral populations, nor through general and indiscriminate processes of cultural diffusion. Rather, these similarities would appear to have been acquired and maintained as a coherent 'package' of traits that are functionally inter-related by the age-set system.

Bettinger and Eerkens' (1999) study of the transmission of arrow-point forms among indigenous populations in the Great Basin of the western United States (Bettinger and Eerkins 1999) has also been cited in support of the 'multiple packages' hypothesis (Shennan 2002). However, in contrast to the previous example, this study suggests that coherent cultural traditions can be maintained even when traits are not functionally interdependent. Bettinger and Eerkens point out that, while the weight/width ratio of arrow-heads did not change in Central Nevada assemblages, populations in eastern California experimented with these variables to optimise the design of the original arrow-head form. Therefore, the correlation between the width and weight of arrow-heads in Central Nevada cannot be explained by inherent design constraints. Instead, Bettinger and Eerkens hypothesise that, while in eastern California bow-and-arrow technology evolved through 'guided variation' (i.e. individual trial-and-error learning), populations in Central Nevada adopted and transmitted bow-and-arrow technology through 'indirect bias' (e.g. Boyd & Richerson 1985). As mentioned previously, indirect bias refers to the type of cultural transmission in which learners copy all the attributes of a successful cultural model, rather than selecting and experimenting with individual traits. Bettinger and Eerkens' explanation of the distribution of arrow-point forms in the Great Basin suggests that indirect bias is likely to be important process in generating the temporally and geographically stable cultural traditions proposed by the 'multiple packages' hypothesis. It can also be speculated that, in other cases, indirect bias might be important in insulating and stabilising 'core traditions' from contact between neighbouring groups and individual experimentation.

In fact, one of the central problems with the studies discussed here is that the cultural evolutionary mechanisms that have been hypothesised to produce 'core traditions' and 'packages' are broadly the same. They include self-reinforcing behaviours, symbolic and functional constraints and cultural transmission biases. However, the circumstances under which these mechanisms produce cultural traditions that are associated with population histories, or independent cultural lineages that might conflict with them, are poorly understood. Thus, rather than representing a solution to the phylogenesis/ethnogenesis problem, the 'core traditions' and 'multiple packages' models raise a new set of issues that, so far, have remained largely unexplored.

1.5 Goals of the Present Study

This thesis aims to contribute to debates outlined above in three ways. The first and most basic objective of the research presented here is to add to existing case studies by investigating the phylogenesis/ethnogenesis problem using new data. Building on an earlier study of Turkmen textile designs carried out with Mark Collard (Tehrani and Collard 2002), this study will focus on the relative contributions of branching and blending in generating a broader range of woven craft traditions associated with an ethnically and linguistically heterogeneous group of tribal populations in Iran and Central Asia. Secondly, this project represents the first systematic attempt to test the predictions of all four hypotheses discussed in this chapter. While previous studies of quantitative cultural data have focused exclusively on the phylogenesis and ethnogenesis hypotheses, the potential value of the 'core traditions' and 'multiple packages' hypotheses require a more rigorous assessment than is possible using current evidence. In meeting this challenge, this project employs a unique combination of analytical techniques to investigate the evolution of woven craft traditions among tribal populations in Iran. Specifically, cladistic methods were used in conjunction with ethnographic fieldwork to investigate the existence of potential craft lineages and establish the mechanisms that might have generated them. Thus, the third objective of this case study is to contribute to the methodological advancement of evolutionary approaches to the study of cultural variation. The techniques used in this case study, and the specific anthropological context in which they were applied, are explained in detail in the next chapter.

CHAPTER 2

The Case Study

2.1 The Ethnographic Context

The project presented in this thesis will address the issues raised in the previous chapter in relation to a long-standing anthropological problem: the origins and maintenance of cultural diversity among tribal populations in Iran (e.g. Morier 1837; Field 1939; Barth 1961; Beck 1986). The locations of the major tribal groupings in Iran is shown on the map in Figure 1. They include populations who speak Persian, Turkic and Arabic languages (Figure 2). Ethnohistorical and linguistic evidence suggests that these ethnic/tribal groups have remained fairly stable for a long period of time. For example, it appears that the persistence of Arabic and Turkish-speaking populations in the south-west of the country has been achieved without further introductions of native speakers to the region since the 15th century (Barth 1961:131, Beck 1986). Similarly, although Modern Persian (*farsi*), the most widely spoken language in Iran, has been strongly influenced by borrowings from Arabic following the introduction of Islam to the country (circa. 637 A.D.) and is written in Arabic script, many of the non-written Persian dialects spoken by tribal and other rural populations seem to have preserved archaic lexical elements associated with Middle Persian (Khosravi 1982). These examples suggest that the languages spoken by tribal populations in Iran have changed at a slow rate and that blending between unrelated languages (e.g. between Persian and Turkic or Arabic languages) has made a neglible contribution to processes of linguistic change among these groups.

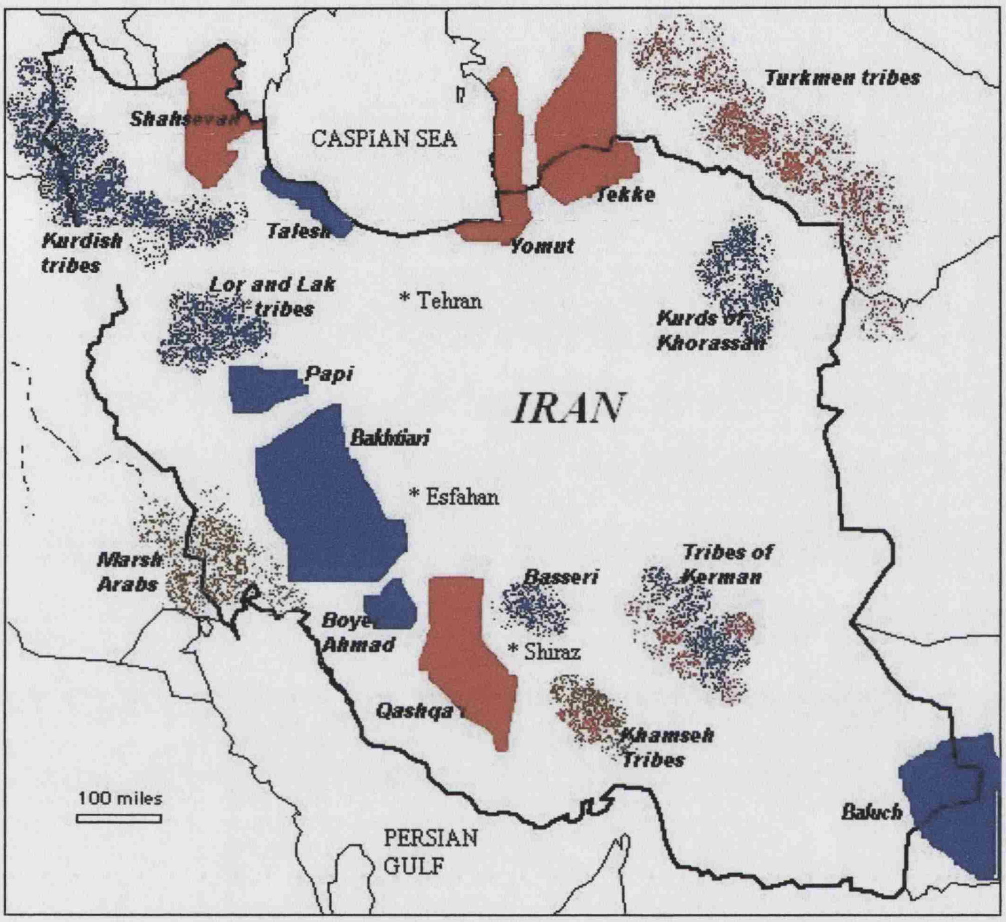


Figure 1: Ethnographic map of Iran showing the geographical distributions of the major Iranian tribal groups, or 'confederacies' (sources: Tapper and Thompson 2002, Mackie and Thompson 1980). Groups whose territories are marked in blue speak Persian languages. Areas marked by red indicate the territories of Turkish-speaking populations and those in brown represent Arabic-speaking groups. The Khamseh Confederacy in the south-west of the country includes Arabic and Turkish-speaking populations, as well as the Persian-speaking Basseri tribe, while the tribes of Kerman province in central/eastern Iran consist of Persian and Turkish-speaking tribes that are not affiliated to a confederacy. This study focused on 9 populations, whose territories are highlighted in bold, solid colour.

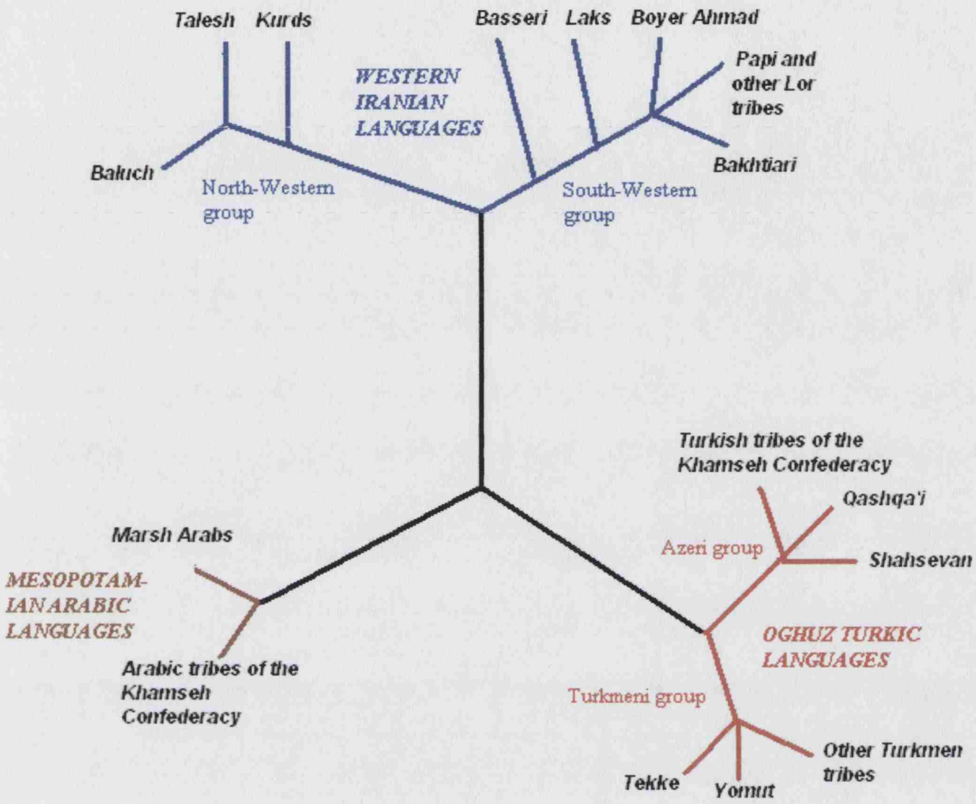


Figure 2. Phylogeny representing the linguistic relationships among Iranian tribal populations (after Grimes 2002). The tribes divide into three principal groupings: Mesopotamian Arabic-speakers (brown branches), Oghuz Turkic-speakers (red branches) and Western Persian-speakers (blue branches). Mesopotamian Arabic is a branch of the the Arabic group of the Semitic language family, while Oghuz Turkic belongs to the Altaic family. Western Iranian languages are a branch of the Indo-Iranian languages belonging to the Indo-European family. Whereas Western Iranian languages are native to Iran, Arabic and Turkic-speaking groups have been present in the country since the seventh and thirteenth century respectively and the origins of both these languages and Persian predate their arrival in the country. Note that the lengths of the branches are not proportional to the exact chronology of language-splits represented in the phylogeny (which cannot be precisely dated based on current evidence). Nevertheless, the relationships between the languages spoken by Iranian tribal groups can be categorised into several further sub-groups based on their similarities and geographical origins: Thus, Persian-speaking populations are divided into 'North-Western' and 'South-Western' groups, while Turkic-speaking groups are divided into an Azeri group and a Turkmeni group.Both Arabic groups speak related dialects of Mesopotamian Arabic, which is distinct from the Gulf Arabic spoken by coastal (non-tribal) populations of Arabs in southern Iran.

Further evidence of the importance of descent in linguistic evolution among these groups is provided by specific instances in which populations have been separated by migrations, such as the Qashqa'i and Shahsevan tribes and the Baluch and Talesh (Fig. 2). In the former case, both the Qashqa'i and Shahsevan speak mutually intelligible dialects of Azeri Turkish, which is believed to be related to the languages spoken by the Oghuz Turkic tribes that swept through Iran between the $13^{th} - 15^{th}$ centuries (Amir-Moez 2002; Barthold 1962). The Qashqa'i are believed to have migrated from the north-western region of Iran, which the Shahsevan currently inhabit, to the south-western province of Fars many hundreds of years ago, possibly as early as the 14^{th} Century (Amir-Moez 2002). Despite the absence of contact between the two groups subsequent to this period, there appears to have been little or no divergence between the languages spoken by them (Beck 1986; Amir-Moez 2002). In the second case, the Baluch are believed to have migrated from the Caspian Sea basin in north-western Iran to their present territories in eastern and south-eastern Iran and Pakistan 900 years ago, according to some estimates (e.g. Salzman 2000; Thompson 2002). Nevertheless, their language is still affiliated to the North-Western branch of Indo-Iranian languages, which is spoken by groups in their original homeland, such as the Talesh, and appears to have been only minimally influenced by neighbouring groups (Salzman 2000; Grimes 2002).

On the other hand, ethnographic and historical accounts relating to the formation and organisation of tribal communities in Iran cast doubt on the historical coherence and continuity of these social entities (e.g. Barth 1961; Beck 1986, 1991; Tapper 1979, 1991, 2002; Salzman, Street and Wright 1995). These studies have highlighted that even the application of the term 'tribe' to Iranian groups is problematic, since in this context it is variously used to denote a nomadic-pastoralist system of economic production, ethno-linguistic entities based on common ancestry, and territorial descent groups headed by local chiefs (*khans*). Although all three of these characteristics are present in a number of groups, inconsistencies in the usage of the term 'tribe' arise in cases where some members of descent or political-territorial groups settle and adopt agriculture. The notion that tribes comprise distinct ethno-linguistic groups is similarly problematic, since many 'tribal' groups share ethnic and linguistic ties to sedentary and urban communities - such as the Basseri tribe, whose dialect is very similar to that spoken in the nearby city of Shiraz; and the Shahsevan, who are ethnically and linguistically associated with a much larger regional population of Azeri-speakers (Barth 1961; Tapper 1997). Moreover, ethnographers (e.g. Barth 1961) have noted that local usage of 'ethnic' appellations frequently refers to the political units to which tribal communities are affiliated rather than implying linguistic or genetic distinctions. Thus the Turkish-speaking Baharlu tribe is usually referred to as 'Arab', on account of their association with the Arab-dominated Khamseh Confederacy, whereas 'Turkish' identity is assigned to tribes belonging to the Qashqa'i Confederacy, which includes groups of Lor ancestry (Barth 1961:131).

Most anthropologists therefore favour a definition of Iranian tribes that is based on specific forms of social organisation rather than on economic organisation or ethno-linguistic categories (e.g. Barth 1961; Tapper 1979, 1991, 2002; Salzman, Street and Wright 1995; Spooner 1982). However, there has been some debate as to how tribal social organisation should be characterised. A number of researchers argue that the notion of tribes as 'territorial descent groups' is based on a simplistic and misleading application of a 'lineage theory' model (e.g. Linder 1983; Barth 1969; Salzman, Street and Wright 1995; Beck 1986; Tapper 1997). The latter, which was originally developed to explain patterns of social organisation among African tribes (e.g. Evans-Pritchard 1940), assumes that membership of Iranian tribal communities is primarily determined by patrilineal descent, whereby the integration of smaller units (e.g. camps/households or herding units/villages) into larger ones (e.g. 'sub-tribal sections', 'sub-tribes' or 'tribes') is associated with increasingly inclusive levels of genealogical relatedness, traced through the male line. Since, according to the lineage theory model, social structure is determined by genealogy, the growth and multiplication of tribal populations is linked to a process that Barth refers to as 'segmentation' (Barth 1961). Segmentation occurs when the number of households in a herding unit/village exceeds the limit that can conveniently share undivided pastoral/ agricultural resources, or when larger tribal entities can no longer be effectively administered as a single unit (Barth 1961:132). The segmentation of Iranian tribal populations exemplifies the splitting processes through which new new cultural entities arise in the phylogenesis model.

However, anthropologists have questioned whether lineage theory is an appropriate model for Iranian tribal social organisation, since many units do not seem to be as genealogically coherent as would be expected (e.g. Spooner 1982; Tapper 1991; Salzman, Street and Wright 1995). Thus, a number of studies have emphasised that, although aspects of Iranian tribal social organisation appear to fit lineage theory, membership of social groups – particularly on higher social structural levels – is often based on principles other than patrilineal descent, such as shared interests or political alliances (e.g. Barth 1969; Salzman, Street and Wright 1995; Beck 1986; Tapper 1997). For example, one commentator has noted that "many of the groups come from different sources: different ancestors, different tribes, and even different ethnic-language groups. Their unity derives from the recognition of a single leader, a *khan* from a noble lineage" (Salzman in Salzman, Street and Wright 1995:123). In these cases, group formation occurs not through segmentation, but through a second process which Barth terms 'aggregation' (Barth 1961). Aggregation involves blending processes that are similar to those predicted by the ethnogenesis hypothesis, although the precise circumstances of aggregation may vary (Barth 1961). These include cases when larger or wealthier units assimilate 'client' groups from declining or impoverished communities, or when tribal unions ('confederacies') dominated by one ethno-linguistic group grow by absorbing previously separate, even unrelated populations. For example, the expansion of the Turkic-dominated Qashqa'i confederacy in the 19th century is believed to have occurred partially through the absorption of non-Turkish groups, such as the Kashkuli tribe, whose oral traditions suggest that they are primarily descended from a Persian, Lor-speaking population, although they now speak Turkish (Barth 1961; Beck 1986). This type of aggregation is in some ways analogous to the 'core and periphery' model of cultural evolution, since the resulting expanded units are identified with the linguistic and ethnic group of the original 'core' community (Barth 1961).

In other cases, heterogeneous tribal entities are known to have been created artificially by the Iranian state to increase its regional influence or act as a counterbalance to other powerful tribal groups. Both the Shahsevan (Tapper 1997) and Khamseh (Barth 1961) confederacies are believed to have originated in this way, with the latter comprising Persian, Arabic and Turkish-speaking groups. Although this might be expected to promote blending between linguistically and culturally distinct populations, Barth believes that in some cases, the institution of centralised chieftainship might allow linguistic and cultural differences to persist: since co-operation between the component groups of a tribe or confederacy are mediated almost exclusively by hereditary *khans*, ordinary members of allied communities are unlikely to have had direct contact or significantly influenced each other (Barth 1961). In such cases, aggregated tribal entities may not comprise a single core, but consist of 'many coherent units' (Boyd et al. 1997).

However, other examples of aggregation appear to conform more closely to the ethnogenesis model's prediction that social entities frequently disintegrate, merge and reform. This might occur when members of two or more declining tribes or sections join forces to forge more viable pastoralist communities or to take up banditry (Barth 1961:132). The new groups might be initially bi-lingual in the languages of the parental units, but ultimately adopt only one language or a *lingua franca*, such as Farsi (Barth 1961:133). The origins of the Kurdshuli tribe conforms to this type of aggregation. They appear to have emerged as an independent unit over the last century following the defection of sections affiliated to various Turkish Qashqa'i and (Persian-speaking) Lori Mamassani tribes (Barth 1961:133). Similar processes are evident in Wright's field study of aggregation among smaller tribal communities in Doshman Ziari, in south-western Iran (Salzman, Street and Wright 1995). She reports that conflicts arising from feuds result in the frequent re-configuration of individual and group alliances, generating 'kaleidoscopic' clusters that cut-across kinship and other ties. The resulting entities bear little resemblance to the genealogically coherent units envisaged by lineage theory, which Wright criticises as a product of ethnographers' over-reliance on members of the tribal elite, who justify their privileged position by presenting themselves as the heads of a 'big family' (Salzman, Street and Wright 1995).

Anthropological studies of group formation and organisation among Iranian tribal populations indicate that the origins and maintenance of ethno-linguistic and cultural distinctions are somewhat more complex than the linguistic evidence suggests. Although some groups might originate through 'segmentation' and remain stable for reasonably long periods, the numerous instances and types of 'aggregation' cited above indicate that patterns of social organisation frequently transcend ethnic and linguistic distinctions. This raises questions regarding how broader patterns of cultural variation associated with Iranian tribal populations might have evolved. In this case study, the problems raised by inconsistencies between the linguistic evidence and ethnographic data will be addressed in relation to material culture variation among Iranian tribal populations. Specifically, this investigation will focus on the extent to which the craft traditions associated evolved by inheritance from ancestral groups, or by borrowing and blending between contemporaneous groups.

2.2 Material Culture

To date, no systematic survey of material culture variation among tribal populations in Iran has been published. However, a number of researchers have documented artefacts produced by tribal groups within more localised areas in western and south-western Iran (e.g. Digard 1981; Mortensen & Nicolaisen 1993; Allgrove 1976; Willborg 2002), western and southern areas of the Caspian Sea basin (e.g. Bazin 1980; Tanavoli 1985) and frontier regions of Iran, Turkmenistan, Afghanistan and Pakistan (e.g. Azadi 1975; Mackie and Thompson 1980; Konieczny 1979). Woven textiles are especially ubiquitous in these assemblages, fulfilling a wide range of functions, from the mundane and utilitarian to the ornamental and ceremonial. A list of commonly made woven objects includes pile-woven carpets, flat-woven (tapestry) blankets and coverings, saddle-bags, animal trappings, salt-bags, tent canopies and decorative hangings, packing bands, articles of clothing and even small pockets for carrying spoons. A number of other textiles are made by felting, such as tent 'walls', felt carpets, cloaks and hats.

The materials and equipment required for weaving and felting are easy for tribal communities to obtain locally and transport on their migrations. Wool is sheared from sheep and, for some fabrics, goats, while dyes were extracted from plants, insects and fruits, although many have now been replaced by chemical dyes bought at town markets. In the past, horizontal, portable looms were constructed from wood, but today they usually consist of inter-locking metal poles purchased from itinerant metal-smiths known as *ghorbat* ('gypsies'), along with beating combs and tools for spinning wool and cutting yarns. Not only are these materials readily available to pastoral-nomadic and semi-pastoral nomadic communities, but the objects made from them are better suited to a migratory lifestyle than items made from other materials, since they are generally lighter and can be folded or rolled.

The numerous and often quite sophisticated techniques used to produce textile objects can be divided into three main categories: pile-weaving, flat-weaving and tablet-weaving (Figs. 3 - 5). The first two techniques both require the horizontal ground loom (Fig. 3). In pile-weaving, individual yarns are knotted and cut in horizontal rows across warp threads, which run vertically along the length of the loom. Each row of knots is secured by a row of weft yarn woven between alternate warp threads, and beaten into place with a heavy metal comb. The cut-ends of the pile knots render designs in a 'pixel' pattern, whereby more complex, curvilinear designs require higher knot densities (Fig. 4). This technique is particularly associated with the production of carpets and *gabbeh* ('rough pile' or 'long pile' carpets with low knot densities, in which simple, angular designs are expressed in low resolutions). Some groups, such as Turkmen tribes in the frontier regions of Iran, Afghanistan and Turkmenistan, also use pile-weaving methods to make tent and saddle-bags (Mackie and Thompson 1980; Azadi 1975). In flat-weaving, dyed weft yarns are wrapped around two or more warp threads to construct a pattern of interlocking, geometric designs (Fig. 4). Simple, 'weft-faced plain-weaving' techniques are used to make black goat hair tent canopies, blankets, and to finish carpets and bags. More complex flat-weaving methods, such as 'slit-tapestry', 'weft-float brocading' and 'sumac', are used to create patterns on *gelim* ('kilim') carpets, *jajims* (a coarse covering made of several flat-woven strips that are sewn together), saddle-bags and animal trappings. The last weaving technique, 'tablet-weaving' does not require a horizontal loom. Instead, warp yarns are threaded through perforated cards and twined around weft yarns to generate patterns by turning the cards (Fig. 5). This technique is commonly used to make packing bands, tent bands and straps.

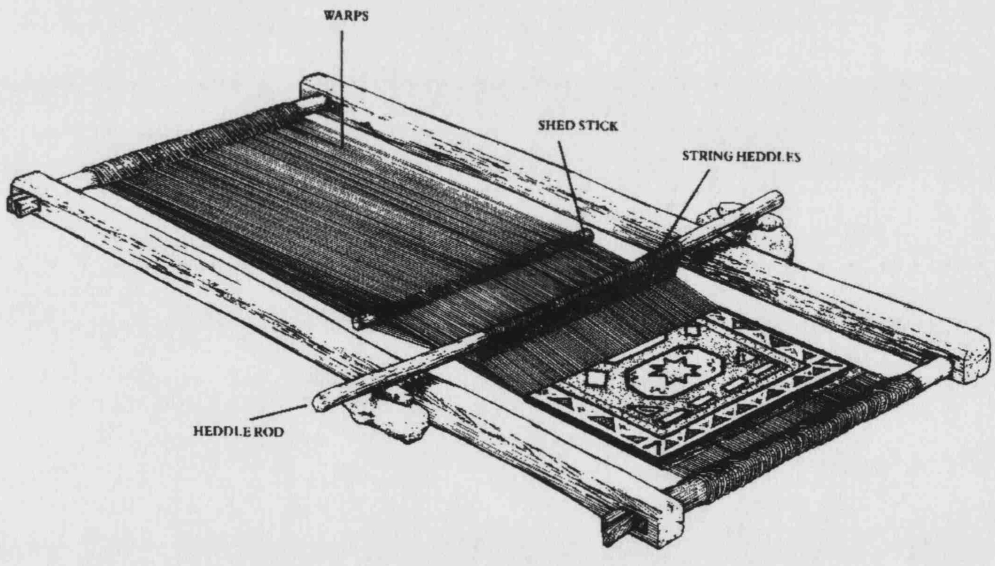


Fig 3: The portable horizontal ground loom favoured by nomadic-pastorist populations in Iran (after Thompson 1983). The ends of the warp are stretched by a frame constructed from wooden beams or metal poles. The heddle rod and shed stick function to separate alternating warp yarns, around which the weaver ties carpet knots/ flat-weaving stitches in horizontal rows (below).

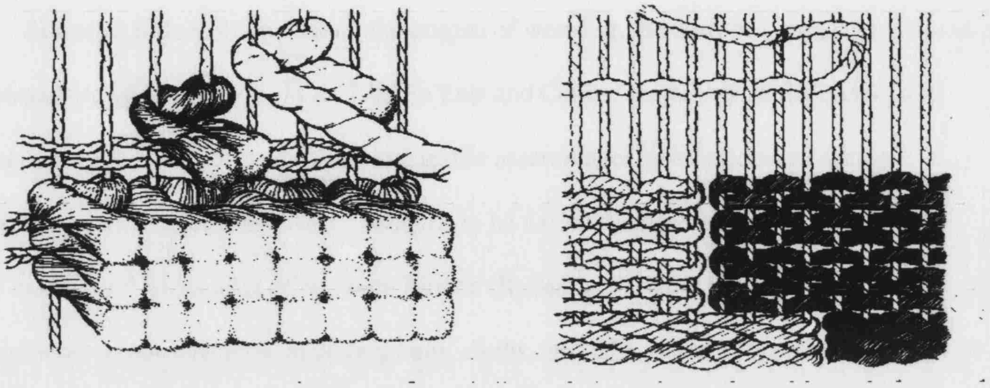


Fig 4: Pile knots (left) and flat-weaving stitches (right) (after Thompson 1983). The former renders designs in a 'pixel' pattern, while the latter generates geometric blocks of colour.

Fig 5: Tablet-weaving (photographed in Chahar Mahal va Bakhtiari Province, May 2002). Here the weaver creates patterns by twisting perforated cards, through which warp threads of alternating colour are threaded.

Although little is known about the origins of weaving, the craft has long been associated with nomadic-pastoralist tribes in the Middle East and Central Asia. One of the oldest, and certainly the best preserved, archaeological textile assemblages was discovered during excavations of a nomadic burial site – believed to be a tribal leader's tomb - in the Pazyryk Valley in the Altai Mountains of southern Siberia (Rudenko 1970). It includes a pile-woven rug and fragments of other textiles, including bags, cloths, and felts, dated at approximately 2,400 B.P. Although the provenance of these objects and the origins of the people who made or acquired them are uncertain, this finding suggests that, at the very least, the affinity between nomadic-pastoralist tribal groups and a textile-based material culture has deep historical roots. However, the circumstances and processes through which textile crafts were initially acquired by these communities are poorly understood. While some studies have suggested that the geographical distributions of many cultural traditions are probably linked to the expansion of specific speech communities (e.g. Gray and Jordan 2000; Holden 2002), weaving appears to have been either independently invented by Persian, Arabic and Turkish-speaking groups, or spread through cultural diffusion. Since the latter scenario is more likely, it seems reasonable to assume that patterns of material culture variation among tribal groups in the Middle East and Central Asia probably arose through borrowing and blending, as predicted by the ethnogenesis hypothesis. However, as Shennan (2002) has remarked, it is also possible that traditions that have been acquired through contact with other societies are subsequently transmitted from parents to their offspring, and evolve through phylogenetic processes of inheritance and diversification in later generations. There is evidence of this process in the evolution of Turkmen woven assemblages. Although many of the designs used by Turkmen weavers are believed to originate in external sources, such as Iranian court carpets and Chinese textiles (Thompson 1980; Opie 1992), a cladistic analysis of these traits indicated that inter-assemblage variation can be mostly accounted for by a phylogenetic, branching model of descent (Tehrani and Collard 2002). Thus, although many of the designs associated with Turkmen weavings may have been initially acquired through borrowing, they were subsequently transmitted mainly between members of the same social group and from ancestral to descendent groups, rather than between contemporaneous groups (ibid.).

Unfortunately, there are relatively few references to craft transmission in the tribal Iranian ethnographic record that might shed further light on these problems (e.g. Irons 1980; Beck 1986, 1991). However, the substantial literature that has been generated by collectors and scholars of tribal carpets (e.g. Housego 1978; Eiland 1981; Ponomaryov 1980; Opie 1992; Mackie and Thompson 1980; Thompson 1983; Tanavoli 1985) generally assumes that weaving activities in rural communities are connected to the reproduction of relatively homogeneous and long-lasting craft traditions. For example, Ponomaryov (1980:29) has commented that, among the Turkmen, "the craftswoman is conservative; she strictly upholds the customs of her craft, preserving age-old forms, repeating the patterns which she has been taught, and which have become hallowed by tradition". In this literature, carpets and other textiles are usually classified according to a taxonomy in which they are identified with specific ethnic/tribal groups (e.g. 'Turkmen' or 'Bakhtiari') that are also assumed to be historically stable. However, studies that have focused on the consumption of tribal carpets as objects of 'primitive art' have criticised these notions as romantic, 'orientalist' fantasies peddled by rug merchants to appeal to Western preconceptions of tribal societies (e.g. Spooner 1986; Helfgott 1994; Baker 1995). Spooner (1986), for instance, dismisses carpet literature classifications as an exercise in 'branding' that is based on misleading assumptions regarding unchanging, 'primitive' cultures and has little to do with the actual conditions or context of carpet production. Accordingly, Helfgott (1994) has proposed an alternative taxonomy based on specific production regimes, in which textiles are divided according to whether they were made in nomadic-pastoralist communities, settled tribal groups, non-tribal sedentary populations, or in commercial workshops which copy tribal styles.

Implicit to the critique of the tribal carpet literature is the suggestion that, in reality, craft transmission is unlikely to be conservative, nor specifically associated with distinct genetic/linguistic lineages (e.g. Spooner 1986; Helfgott 1994; Baker 1995). However, since neither view is based on a systematic assessment of empirical evidence, the problem of how patterns of material culture variation among Iranian tribal populations were generated remains largely unexplored. The case study presented here addresses this problem using two approaches: cross-cultural analyses of quantitative data and ethnographic observation of craft transmission. This strategy is briefly outlined in the remainder of this chapter.

2.3 Quantitative Methods

The relative contributions of branching and blending processes to the evolution of Iranian tribal craft assemblages were investigated using the method currently favoured by biologists for reconstructing the evolutionary histories of species - cladistics (Hennig 1950, 1965, 1966; Eldredge and Cracraft 1980; Wiley 1981; Ax 1987; Wiley et al. 1991; Minelli 1993; Quicke 1993; Kitching et al. 1998; Page and Holmes 1998; Schuh 2000). Following Foley's analysis of hominid stone tools (Foley 1987), cladistics has been used by a number of researchers in evolutionary archaeology and anthropology (e.g. Gray and Jordan 2000; Collard and Shennan 2000; Collard and Shennan 2001; Foley and Lahr 2003; Robinson and O'Hara 1996; Barbrook et al. 1998; Spencer et al. 2004; O'Brien et al. 2001, 2002; Holden 2002; Tehrani and Collard 2002; Jordan and Shennan 2003). This approach can be defended on three grounds. Firstly, as O'Brien and colleagues have pointed out, the utility of phylogenetic methods in general, and cladistics in particular, is not limited to the study of biological diversity, but extends to any cases where variations in the traits exhibited among a group of entities are believed to result from differential transmission processes – including those relating to social learning (O'Brien et al. 2001).

Secondly, the particular advantage of cladistics over other phylogenetic methods (e.g. numerical taxonomy) is that, rather than linking taxa according to the overall number of similarities they share, the former is specifically concerned with distinguishing between similarities resulting from descent (homologies), and those deriving from other processes (homoplasies) (e.g. Quicke 1993; Wiley 1981; Wiley et al. 1991). The cladistic method is therefore particularly well suited to investigating processes of cultural diversification, where the challenge is to establish the extent to which shared cultural traits have been inherited from a common ancestral assemblage, or derive from processes other than descent. Although the processes responsible for generating biological and cultural homologies are not the same (gene transfer versus social learning), and those responsible for generating biological and cultural homoplasies probably also differ (i.e. independent evolution versus diffusion), the two problems are sufficiently similar in terms of epistemology and ontology to justify the application of cladistic methods to cultural data.

Thirdly, using cladistics it is possible to determine the extent of branching and blending processes in generating resemblances between different cultural assemblages independently of linguistic and geographical controls. The latter are associated with regression-based studies of cultural diversification (e.g. Welsch et al. 1992; Moore and Romney 1994, 1996; Roberts et al. 1995; Guglielmino et al. 1995; Welsch 1996; Hewlett et al. 2002), and can be criticised on two points: Firstly, since neighbouring groups are often closely related, the use of geographical proximity as a proxy for ethnogenesis is likely to exaggerate the influence of the latter, and underestimate the role of phylogenesis (Collard and Shennan 2000; Tehrani and Collard 2002). Secondly, the use of a language phylogeny as a proxy for cultural descent is similarly problematic, since it assumes that patterns of linguistic, genetic and cultural inheritance are commensurate with one another – a notion which has been criticised by some researchers (Rogers and Cashdan 1997; Cashdan and Rogers 1997; Borgerhoff Mulder 2001). Whereas the phylogenesis hypothesis predicts a close correlation between population histories, linguistic transmission and cultural diversification, some theorists (e.g. Boyd et al. 1997; O'Brien et al. 2002; Shennan 2002) have suggested that although populations, languages and cultural assemblages might each arise through phylogenetic splitting, their evolutionary histories might diverge. Consequently, a language phylogeny might be a misleading indicator of branching processes in other cultural domains.

In view of these problems, this study evaluated predictions relating to the relative contributions of branching and blending processes to the evolution of Iranian tribal craft assemblages and the extent to which cultural patterns coincide with population histories and linguistic relationships separately. In the former case, the processes responsible for generating similarities between different groups' craft assemblages were investigated using several techniques associated with cladistic analyses. The first technique employs a null model in which new taxa arise from the bifurcation of existing ones, thereby generating a tree diagram, or cladogram. This links taxa in such a way that the number of hypotheses of character origin required to account for the similarities among them is minimized. Since a tree model is the simplest way to link a group of taxa, the use of this null model invokes the principle of parsimony, the methodological injunction which states that explanations should never be more complicated than is necessary (Sober 1988). Analyses of data sampled from the Iranian tribal material assemblages were carried out in the computer software program PAUP 4.0* (Swofford 1998) using a technique known as a 'branch and bound search', which employs an exact algorithm to identify the optimal cladogram for a given group of taxa through a process of elimination (in which less parsimonious alternatives are discarded). The resulting tree for the material culture assemblages included in each analysis therefore represented the best explanation for the distribution of shared traits based on the null model of a bifurcating tree, the so-called 'minimum length' cladogram (Wiley et al. 1991; Minelli 1993; Quicke 1993; Kitching et al. 1998; Schuh 2000).

Once a tree has been generated, resemblances among the taxa included in the analyses can be classified as homologous or homoplastic. Homologies result from shared ancestry and their distributions are therefore consistent with the tree. The distribution of homoplasies, on the other hand, conflict with the tree since they result from processes other than descent. In biological data sets, homoplasies are likely to result from independent evolution, such as when unrelated species share certain adaptive traits which evolved in response to similar ecological challenges (convergence). In cultural data sets homoplasies may result from independent evolution (e.g. convergence or independent invention), but can also arise through the transmission of traits between contemporaneous societies. The latter is likely to be especially important in generating homoplasies in data sampled from a reasonably well-defined and localised region, as is the case here (see also Borgerhoff Mulder 2001). Consequently, the relative contributions of branching and blending to cultural evolution were assessed in relation to the ratio of homologous and homoplastic traits in a given set of data. This ratio was determined in PAUP 4.0* (Swofford 1998) using two measures of how well the craft traits data fitted the bifurcating tree model: the Consistency Index (CI) of the optimal cladogram and 'bootstrapping'.

The CI evaluates how parsimonious evolution has been for a given combination of cladogram and data set (Kitching et al. 1998). The CI for a single character is calculated by dividing the minimum number of character state changes required by any conceivable cladogram (m) by the number of changes required by the optimal cladogram (s). The CI for two or more characters is computed as M/S, where M and S are the sums of the m and s values for the individual characters. A CI of 1 indicates that the data are perfectly congruent with the cladogram (i.e. the cladogram requires no homoplastic changes to be hypothesised), and homoplasy levels increase as the CI decreases. The second technique, bootstrapping, was originally developed as a way of estimating the statistical likelihood of a given clade being real (Felsenstein 1985). However, following several recent critiques (e.g. Carpenter 1992; Kluge and Wolf 1993), it is now considered by many researchers to be a heuristic tool rather than a statistical test (Kitching et al. 1998; but see Sanderson 1995). In bootstrapping, a large number of subsets of data (normally 1,000 to 10,000) are randomly sampled with replacement from the character state data set, with the character state assignments being retained in each sample. Minimum length cladograms are then computed from these subsets of the data, and a list of the clades that comprise the cladograms compiled. Thereafter, the percentage of clades yielded by the resampled data that support the most parsimonious cladogram returned for the original data set is calculated. Data sets that fit the bifurcating model with little conflicting signal will return higher percentages of support in the bootstrap analyses.

2.4 Qualitative Methods

Further assessments of the utility of the phylogenesis, ethnogenesis and other models of cultural diversification were based on how patterns in the craft traits compare to ethnohistorical, linguistic and geographical data, and on ethnographic data relating to micro-level processes of craft transmission. In the former case, similarities between different craft assemblages were interpreted in relation to the groups' population histories and evidence of interactions between neighbouring societies. In the latter case, the evolution of the craft assemblages was considered in relation to weavers' own accounts of how different craft skills and designs are learned, focusing in particular on whether these traits were acquired from members of the same social group, as predicted by the phylogenesis hypothesis, or from external sources too, as suggested by other models. Since, barring a few casual observations (e.g. Irons 1980, 1990; Beck 1986, 1991), ethnographic information relating to these issues is currently lacking, nine months' fieldwork was carried out among Qashqa'i, Boyer Ahmadi Lor and Bakhtiari tribal communities during three visits to western and south-western Iran between June 2001 and August 2003. Assistants were hired on a full-time basis in each of the locations where fieldwork was carried out from local tourist offices or 'cultural institutes'. These assistants also provided transport and invaluable knowledge about the locations of different camps and villages. Accommodation was usually arranged with members of these communities, who kindly allowed us to stay with their families in tents or households, and also provided us with bedding and food.

Roughly 100 hours' observation of weaving was carried out during this period. However, since weaving is carried out exclusively by women, obtaining information from weavers themselves was complicated by the strictly observed norms of sexual segregation in these societies. Consequently, weavers were sometimes unwilling to be interviewed without a male relative/husband being present (who sometimes answered on their behalf), or for sufficiently long periods. Despite these constraints, opportunistic conversation and semi-structured interviews were carried out with approximately seventy female individuals between the ages of 14 and 65 years old. When possible, weavers were interviewed in Farsi (Persian), the *lingua franca* of Iran. In cases when the subject was not fluent in Farsi, interviews were carried out in the local dialect (e.g. Lori or Qashqa'i Turkish) with the help of a field assistant/interpreter. The interviews were mainly concerned with establishing how different craft traits were learned, and from which sources they were acquired. Thus, weavers were asked to explain the techniques involved in making different types of artefact, the age at which they learned these skills and how long they took to master. They were also asked who taught them how to weave (e.g. mother, kin-member, friend, or individuals belonging to other communities) and whether they had continued to learn new skills and designs subsequent to their initial apprenticeship. Of particular concern to this investigation into the phylogenesis/ethnogenesis problem was establishing the extent to which craft skills and designs are learned during childhood through mother-to-daughter transmission, or adopted from neighbouring groups and other external sources in later periods of the weavers' lives. Further questions concerned the potential symbolic associations between different designs and the functional inter-relationships between different traits. These issues are particularly relevant to assessing the 'intermediate' models of cultural diversification discussed in the previous chapter, which propose that cultural assemblages may comprise 'core traditions' or 'multiple packages' of inter-linked traits (e.g. Boyd et al. 1997; Shennan 2002).

2.5 Structure of the Research

The quantitative and qualitative methods described above were used in combination to link macro-level patterns of cultural diversity to micro-level processes of cultural transmission. Three main sets of quantitative data were analysed using cladistic methods. The first data set comprised craft items, techniques and designs sampled from nine Iranian tribal confederacies. Cladistic analyses of this data set are presented in the next chapter (3), in which the two contrasting models of phylogenesis and ethnogenesis were tested. The results of these analyses were compared to those obtained by other investigations into the phylogenesis/ ethnogenesis problem, and discussed in relation to the tribes' population histories and likely interactions with one another. Ethnographic data relating to craft transmission figures more prominently in Chapters 4, 5 and 6, which evaluated the utility of two other models proposed by the 'core and periphery' hypothesis and 'multiple packages' hypothesis respectively. Both models suggest that different types of craft trait are learned and transmitted through different processes, whereby some traits comprise long-lasting, coherent traditions that are associated with specific linguistic/genetic lineages, while others are borrowed and blended on an individual basis. These chapters described how the methods used in Chapter 3 are adapted and refined so that different processes of cultural inheritance and their associations with linguistic and geographical patterns can be established. The remainder of the thesis is concerned with two other sets of data, which are introduced in Chapter 7 and analysed in Chapters 8 and 9. Whereas the previous analyses concerned inter-tribal patterns of cultural diversity, the assemblages from which these data were sampled each belong to a single group of tribes/confederacies. The broader significance of insights yielded by both the inter-tribal and intra-tribal analyses for understanding the origins and maintenance of cultural diversity in Iran, and for wider debates concerning cultural evolution are considered in Chapter 10, the concluding chapter of the thesis.

CHAPTER 3

Phylogenesis or Ethnogenesis? Phylogenetic Analyses of Iranian Tribal Craft Assemblages

3.1 Introduction

This chapter addresses the two most basic and contrasting models of cultural diversification discussed in Chapter 1: 'phylogenesis' and 'ethnogenesis' (Moore 1994; Collard and Shennan, 2000; Tehrani and Collard, 2002). To reiterate, in phylogenesis new cultural entities arise by the subdivision of ancestral assemblages into daughter assemblages as a result of populations splitting and giving rise to new ones (e.g. Durham 1990, 1992). According to this hypothesis, patterns of cultural diversity can be described by a tree-like model of descent, and should be closely correlated with linguistic and genetic patterns. In ethnogenesis, new cultural entities arise by borrowing and blending among contemporaneous societies as a result of processes such as trade and inter-marriage (e.g. Moore 1994, 2001; Terrell 1988, 2001; Terrell et al. 1997). According to this hypothesis, patterns of cultural diversity cannot be described by a tree-like model, and are only loosely, if at all, connected to linguistic and genetic patterns. The predictions of these two models will be investigated through cladistic analyses of data sampled from the material culture assemblages associated with nine Iranian tribal populations. These analyses will investigate whether patterns in the data arose primarily through branching or by blending by testing how well resemblances between the assemblages fit a tree-like structure. Subsequently, the results of the analyses will be interpreted in relation to the available linguistic, geographic and ethnohistorical data to determine whether relationships between the assemblages can be better accounted for by inheritance from ancestral populations or by cultural transmission among neighbouring groups.

3.2 Materials and Methods

A sample of 158 textile-related craft items was selected from the material culture assemblages associated with nine Iranian tribal confederacies, whose territories are highlighted on the map shown in Fig. 1. Confederacies represent formal unions of groups who may share patrilineal descent ties, but may in some cases include unrelated groups who nonetheless recognise a common leader. Although the composition and origins of different confederacies may vary, those included here have remained stable for at least the last 200 years. Each is bonded by a common language, identity and shared historical consciousness (e.g. Barthold 1962; Tapper 1979; Beck 1986, 1991; Salzman 2000; Irons 1974, 1975; Garthwaite 1983). Members of four of the confederacies mainly speak dialects belonging to the Oghuz family of Turkic languages, while the five other confederacies are dominated by Persian-speakers (Table 1). The former comprise two Turkmeni-speaking groups, the Yomut and Tekke, and the Qashqa'i and Il Savan (more usually known as the Shahsevan), whose dialects are closely related to to Azeri, the language of Iranian Azerbaijan. The Persian-speaking confederacies are divided into three Lor-speaking groups, the Bakhtiari, the Papi and the Boyer Ahmadi, and two groups whose languages are associated with the North-Western branch of Indo-Iranian languages, the Talesh and the Baluch (Fig 2).

The sample was drawn mostly from published monographs on the material culture of each group: Bazin's (1980, 1982) survey of the Talesh and other tribal communities inhabiting the south-western basin of the Caspia Sea; Allgrove's (1976) collection of Qashqa'i material culture for the World of Islam Festival of 1976; Konieczny's (1979) contribution to the same event based on several field trips to Baluchi territories; Digard's (1981) classic monograph on Bakhtiari crafts and technologies; Willborg's (2002) survey of the carpet weaving in Bakhtiari villages; Tanavoli's (1985) collection of Shahsevan textiles, mostly purchased in local *bazaars* ('markets') in Iranian Azerbaijan; and lastly, Mortensen and Nicolaisen's (1993) monograph of Papi Lor material culture objects which was sponsored by the Carlsberg Foundation Nomad

Research Project. Although no single monograph exists for either the Yomut or Tekke Turkmen, textiles produced by both these groups can be recognised by a combination of technical traits (Thompson 1980; Azadi 1975; Tzavera 1984; Hoffmeister 1980). Data on the Boyer Ahmadi Lor were collected in Iran from villages and camps in the province of Kuhgiluye-va-Boyerahmad and a private collection of older textiles in Yasuj, a city near Shiraz. A comprehensive list of the textiles included in the sample is presented in Table A1, Appendix A.

Tribal Confederacy	**Location** *(neighbours)*	**Language** *(affiliations)*
Yomut	Eastern basin of Caspian Sea, on SW Turkmensitan/NE Iran frontier *(Tekke)*	Turkmeni *(Tekke)* - Oghuz Turkic *(Tekke, Shahsevan, Qashqa'i)*
Tekke	NE Iran/SW Turkmenistan frontier *(Yomut)*	Turkmeni *(Yomut)* – Oghuz Turkic *(Yomut, Shahsevan, Qashqa'i)*
Shahsevan	NW Iran, western basin of Caspian Sea *(Talesh)*	Azeri *(Qashqa'i)* – Oghuz Turkic *(Yomut, Tekke, Qashqa'i)*
Qashqa'i	SW Iran, Zagros mountain range *(Boyer Ahmad, Bakhtiari)*	Azeri *(Shahsevan)* – Oghuz Turkic *(Yomut, Tekke, Shahsevan)*
Boyer Ahmad	SW Iran, Zagros mountain range *(Qashqa'i, Bakhtiari)*	Lori *(Bakhtiari, Papi)* – Persian *(Bakhtiari, Papi, Talesh, Baluch)*
Bakhtiari	Western Iran, Zagros mountain range *(Qashqa'i, Boyer Ahmad, Papi)*	Lori *(Boyer Ahmad, Papi)* – Persian *(Boyer Ahmad, Papi, Talesh, Baluch)*
Papi	Western Iran, Zagros mountain range *(Bakhtiari)*	Lori *(Boyer Ahmad, Bakhtiari)* – Persian *(Boyer Ahmad, Bakhtiari, Talesh, Baluch)*
Talesh	NW Iran, western basin of Caspian Sea *(Shahsevan)*	Taleshi – North-Western branch *(Baluch)* – Persian *(Boyer Ahmad, Bakhtiari, Papi, Baluch)*
Baluch	SE Iran/ NW Pakistan frontier	Baluchi - North-Western branch *(Talesh)* – Persian *(Boyer Ahmad, Bakhtiari, Papi, Talesh)*

Table 1. Description of the populations from which crafts data were sampled. The first column denotes the tribal/political entity. The second column indicates the territory of each population, with neighbouring groups listed in parentheses. The final column categorises the language spoken by each population, listing the other focal groups whose languages fall into the same categories (after Grimes 2002).

Based on this sample, a data set was prepared for cladistic analysis. Firstly, the textiles were divided into nine taxa, each representing the material culture assemblage associated with one of the tribal populations. Once the sample was divided into taxa, 110 specific craft traits were designated as units of variation, or 'characters'. These included weaving techniques (e.g. spinning, knotting, etc.), the use of different materials (e.g. wool, goat hair, palm fronds, etc.) and decorative features (e.g. carpet designs, border patterns, etc.). Descriptions of the characters and their distributions are provided in Table A2, Appendix A. The data were then used to create a matrix in which the taxon names were listed in the row headings and the characters were listed in the column headings. Character 'states' for each taxon were recorded on a presence/absence basis in the cells of the matrix.

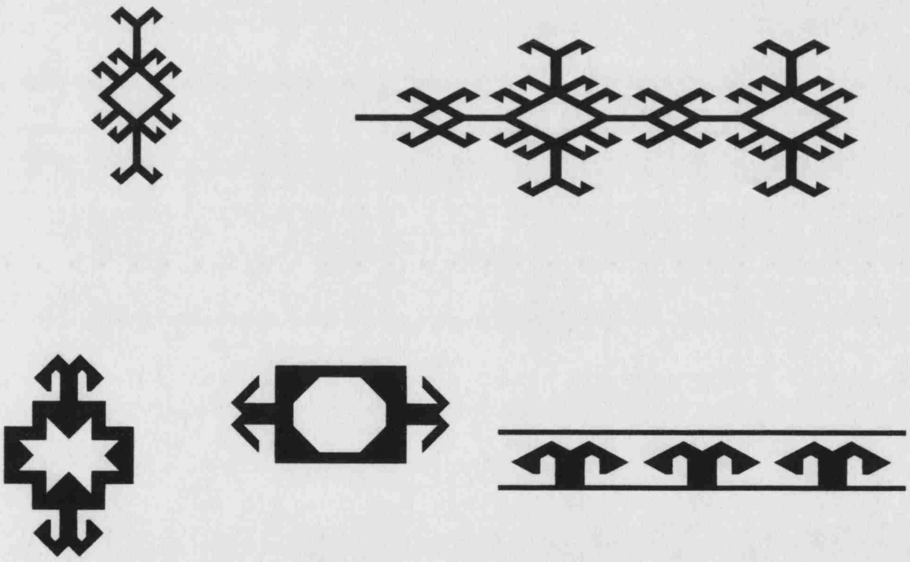


Fig 6: Examples of trait variation: Designs based on 'goat-horn' motifs are widely distributed among the craft assemblages. In the top row, 'goat-horn' motifs extend from a branching diamond medallion, which is used either as an ornament, or an inter-linked pattern by the Bakhtiari and Papi Lors. The expression of these motifs is less angular and less complex in the field designs and border pattern represented in the bottom row, which are associated with the Qashqa'i, Shahsevan, Yomut, Tekke and Boyer Ahmad.

Ten craft items associated with Arab Bedouin tribes of Jordan (Weir 1976) were also sampled in order to construct an outgroup. The use of an outgroup in cladistic analysis has become the most popular method for determining the direction of character state changes when actual ancestors for the taxa under study (the ingroup) are not available (e.g. Quicke 1993, Kitching et al. 1998). The outgroup is defined as a sister taxon to the ingroup, sharing a common ancestor with the latter of more distant origin than that shared by the ingroup taxa. Character states shared by members of the ingroup with the outgroup can be classified as primitive since they are likely to have been inherited from a distant common ancestor, thereby providing a basis for identifying derived character states shared by more closely related taxa. The selection of an appropriate outgroup has been recognised as a major problem in cladistic analyses of cultural data sets (O'Brien et al. 2002) and remains a contentious issue in biology (e.g. Nixon and Carpenter 1993). One solution would be to use another analytical technique for determining the direction, or, in cladistic terminology, the 'polarity', of character state changes that does not require an outgroup, such as 'mid-point rooting'. The latter follows other cladistic approaches by dividing taxa into two groups, or lineages, and are further subdivided into more exclusive clades in a hierarchical, bifurcating pattern. The first principal division (the 'mid-point') is then employed as an ancestral taxon that exhibits the primitive states of each character. However, since this principal division is not guided by any external control on the rooting of the phylogeny (such as an outgroup), the subsequent definitions of primitive and derived states are to some extent arbitrary. Consequently, the use of this technique in has fallen out of fashion, and it is no longer considered a reliable method for reconstructing phylogenies. An alternative solution to the problem of selecting an outgroup would be to artificially construct a 'default' outgroup in which all characters are recorded as absent. Since the absence of a cultural trait logically precedes the invention of it, the lack of a character can be assumed to be the primitive state and the presence of the character the derived state. However, since archaeological evidence suggests that tribal groups in Central Asia have probably been weaving for at least the last 2,400 years (Rudenko 1970), the use of a default outgroup would be a crude device for rooting the relationships among assemblages that probably originated in the more recent past. For example, the splits that are believed to have given rise to the Qashqa'i and Shahsevan and the Talesh and Baluch probably occurred in the last 900 – 500 years (e.g. Beck 1986, Amir-Moez 2002, Salzman 2000). Similarly, the Yomut and Tekke are believed to have emerged as independent entities following the distintegration of the so-called 'Salor Confederacy' in the seventeenth century (Wood 1990), while Iranian state records do not distinguish between the Bakhtiari and other Lor-speaking groups until the sixteenth century (Garthwaite 1980). The advantages of using a more carefully selected outgroup have been noted by O'Brien et al. (2002), who remark that "[A]ny taxon can serve as an outgroup, but the closer the relative, the greater the number of characters likely to be informative at the outgroup node. The closer the phylogenetic relationship is between the outgroup and the ingroup taxa, the better the chances of determining character polarity" (O'Brien et al. 2002:141). This is because character polarity may involve switches between the presence or absence of a trait subsequent to its original invention. A population may inherit a trait that is discarded and not transmitted to descendent groups. Thus the presence of a character might be classified as derived when seen from a distant perspective, but as primitive when seen from a more focused one. It can therefore be reasoned that a population such as the Bedouin of Jordan constitute a more appropriate outgroup than a default outgroup, since they weave textiles that are believed to be closely related to the craft traditions of Iranian tribal groups. This is evident in the materials and techniques they employ, their use of Islamic iconography and even in their 'tribal designs' (see Weir 1976). However, it is also important that the outgroup is not more closely related to any of the ingroup taxa than the latter are to each other, since this would have an equally distorting effect on the rooting of the phylogeny. The Jordanian Bedouin fulfill this criterion since they are geographically, culturally and linguistically distinct from both the Turkish and Persian-speaking tribes. This is not the case for other potential candidates, such as the Kurds, who are related to other North-Western Iranian-speaking groups such as the Talesh and Baluch, or the Kirghiz, who are related to Turkic populations like the Turkmen.

Once the ingroup and outgroup taxa were defined and the characters encoded in the fashion described above, the matrix was analysed in PAUP 4.0* (Swofford 1998) using three techniques. Firstly, a branch-and-bound-search of the matrix determined the most parsimonious explanation for the distribution of resemblances among the assemblages based on the null model of a bifurcating tree (Wiley et al. 1991, Minelli 1993, Quicke 1993, Kitching et al. 1998; Schuh 2000). The fit between the data and the cladogram was assessed in relation to the latter's Consistency Index (CI) as well as the results of a bootstrap analysis. As explained previously, the CI measures the total number of resemblances between the assemblages that are consistent with the cladogram, while bootstrapping provides a statistical test of how well each clade is supported by the data. Essentially, both techniques estimate the proportion of character states that are likely to have arisen by descent, and can be classified as homologous, versus those that result from processes other than descent and can therefore be classified as homoplastic.

3.3 Hypotheses and Predictions

These analyses provide a means of assessing whether the diversification of Iranian tribal craft traditions can be better accounted for by the phylogenesis hypothesis or ethnogenesis hypothesis. The phylogenesis hypothesis predicts that the distribution of resemblances among the craft assemblages will be consistent with a branching, hierarchical pattern of descent. The ethnogenesis hypothesis, on the other hand, predicts that similarities between cultural assemblages arise primarily as a consequence of the blending together of contemporaneous assemblages through trade, inter-marriage or the aggregation of previously separate populations. According to the latter hypothesis, the distribution of similar craft traits will not conform to a tree structure.

Following this logic, it can be reasoned that if the analyses returned a phylogeny for the tribal material culture assemblages with a low level of conflicting signal, then phylogenesis can be reasonably inferred to be the more important process. In this case, the shortest cladogram generated for the tribal crafts data set should be supported by a relatively high Consistency Index (CI) and high bootstrap support values. If, however, the craft traits return a low CI and low bootstrap percentages, it can be concluded that processes other than descent dominated the evolution of tribal craft traditions, thus lending support to the ethnogenesis hypothesis.

3.4 Results

The shortest cladogram returned by a branch-and-bound search of the tribal crafts data set had a length of 188, which represents the minimum number of hypotheses of character-state changes required to account for the resemblances among the assemblages using a bifurcating tree model. The fit between the cladogram and patterns in the tribal crafts data was tested using the Consistency Index (CI) and with bootstrapping. The CI of the cladogram was 0.54, falling considerably short of the ideal value of 1. This suggests that a large number of the character states shared by the taxa cannot be accounted for by the best estimate of phylogeny, and require additional hypotheses of homoplasy. Nevertheless, a CI of 0.54 suggests that more than half of resemblances (54%) among the craft assemblages are consistent with a bifurcating tree and can be therefore classified as homologous. The phylogenetic hypotheses returned by the original analysis of the data were then tested through a bootstrap analysis. The results of this analysis are shown in the cladogram in Figure 7.

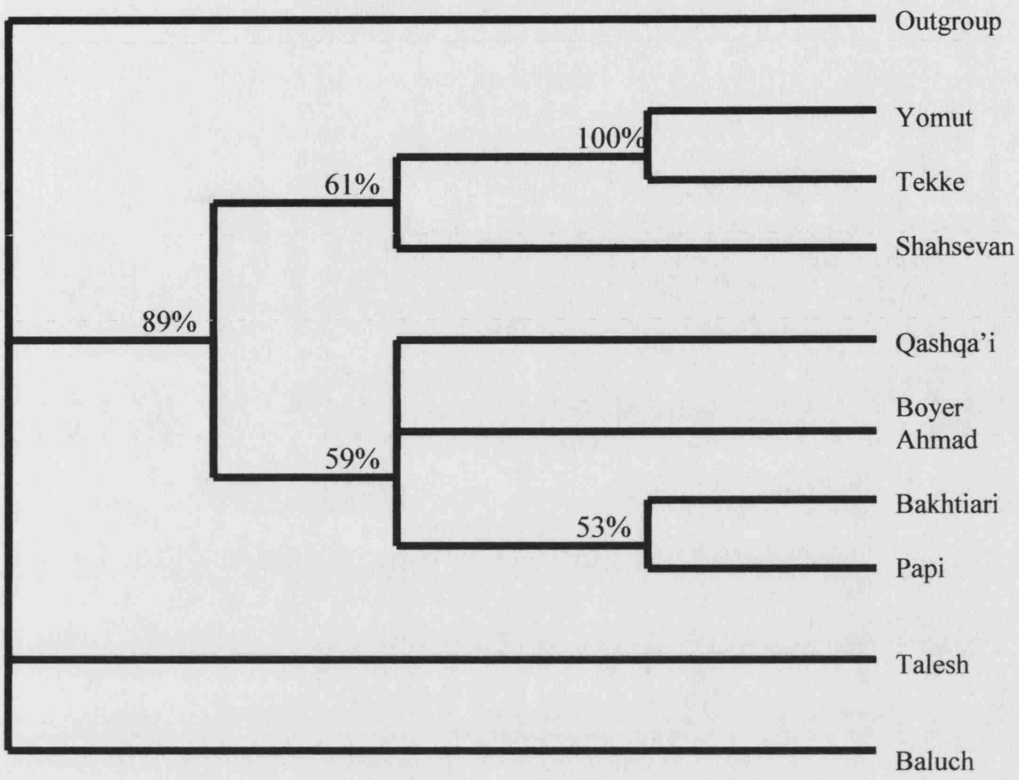


Fig 7: The phylogeny obtained from the tribal craft traits data following parsimony and bootstrap analyses carried out in PAUP 4.0. The phylogeny hypothesises that seven of the craft assemblages descend from a common ancestral assemblage, dividing into two main lineages that each contain subdivisions of more recent origin. The support values for each branch of the tree returned by the bootstrap analysis is represented beside the nodes, ranging from 53% (Bakhtiari and Papi) to 100% (Yomut and Tekke).*

It should be noted that in this revised cladogram the Talesh and Baluch are both excluded from the most inclusive clade. This is because fewer than 50% of the bootstrap cladograms supported the hypothesis that these two assemblages share an exclusive common ancestor with the other ingroup taxa. Moreover, the exclusion of the Talesh and Baluch from the ingroup clade resulted in a shorter tree (length = 173). Thus, according to the results of the analyses, the Talesh and Baluch assemblages are no more closely related to the ingroup taxa than they are to the outgroup taxon. The percentage of support for the clades retained by the bootstrap analysis varied: in the most inclusive clade, 89% of the bootstrap cladograms supported a hypothesis of common origin for the assemblages associated with the Yomut and Tekke Turkmen, the Shahsevan, Qashqa'i, Boyer Ahmad, Papi and the Bakhtiari. The cladogram then divides into two lineages. The first lineage comprises two clades. The first of these clades, with a moderate 61% support, included the Yomut, Tekke and Shahsevan. The second clade excluded the Shahsevan, with 100% support for a relationship linking the Yomut and Tekke. The second lineage also contained two clades. The most inclusive clade, with 59% support, comprised the Qashqa'i; Boyer Ahmadi and Papi Lors; and the Bakhtiari. The second clade included only two of these taxa: the Papi Lor and Bakhtiari. This clade was supported by only 53% of the bootstrap cladograms, indicating that a large number of craft traits associated with both groups contradict the hypothesis that they are descended from an exclusive common ancestral assemblage.

3.5 Discussion

The results of the analyses of the crafts traits data set are not entirely compatible with the predictions of the phylogenesis hypothesis or the predictions of the ethnogenesis hypothesis. Based on the Consistency Index (0.54) of the most parsimonious cladogram obtained for the data, it would appear that resemblances among the Iranian tribal material culture assemblages arose through both branching and blending. Although the CI value indicates that a majority of the resemblances (c. 54%) among the assemblages are consistent with a branching pattern of descent, almost half of the craft traits shared among them conflict with a tree structure, suggesting that they arose through borrowing and blending, or from independent invention. Using the results of the bootstrap analysis, the distributions of resemblances arising by descent (homologies) and those resulting from other processes (homoplasies) can be assessed in relation to the support for each of the clades represented in the cladogram. These values indicate that the roles of phylogenesis and ethnogenesis in generating the craft assemblages varied quite significantly. For example, the clade that proposes an exclusive common ancestor for the Yomut and Tekke is supported by 100% of bootstrap cladograms, suggesting that the origins of these two groups' assemblages can be entirely accounted for by phylogenesis. In contrast, the clade that links the Papi assemblage to the Bakhtiari assemblage was supported by only 53% of the bootstrap cladograms. Ethnogenesis therefore seems to have been far more important role in the evolution of these groups' weaving traditions than in those associated with the Yomut and Tekke. The Talesh and Baluch assemblages, on the other hand, do not appear to be related to any of the other assemblages included in the analyses. Overall, these results suggests that, although a phylogenetic tree is a more useful model for reconstructing the origins of the Iranian woven assemblages than proponents of the ethnogenesis hypothesis would predict (e.g. Moore 1994, 2001; Terrell 1988, 2001; Terrell et al. 1997), it provides an incomplete account of processes of cultural diversification.

These results are broadly in line with those obtained by other recent applications of cladistic methods to investigating the relative contributions of branching and blending in generating material culture variation (e.g. Collard and Shennan 2000; Tehrani and Collard 2002; Jordan and Shennan 2003). The range of bootstrap support values for the clades returned by the analysis carried out here (53% to 100%) is comparable to the results of Collard and Shennan's (2000) bootstrap analyses of prehistoric pottery data sampled from consecutive settlement phases in the Merzbach Valley. In the cladograms obtained by Tehrani and Collard (2002) from data comprising textile designs associated with Turkmen tribes sampled from two historical periods, bootstrap support for individual clades ranged between 60% and 95%. Again, these results are similar to those returned by the bootstrap analysis of the Iranian tribal crafts data. It should also be noted that the results of the analyses carried out here strongly supported Tehrani and Collard's (2002) assertion that phylogenesis dominated the evolution of Turkmen textile assemblages, since the two Turkmen groups included in the sample were grouped in a clade that was present in 100% of the bootstrap cladograms.

However, it appears that ethnogenesis was a more influential process in generating some of the other assemblages from which the data were sampled. This is reflected in the relatively low bootstrap percentages of some of the clades returned by the analyses, and by the Consistency Index (CI) of 0.54. This indicates that nearly half of the total number of resemblances among the assemblages were inconsistent with a branching model of descent. Both the cladograms obtained by Tehrani and Collard in their analyses of Turkmen designs associated with textiles produced prior to and after the Russian conquest of the tribes' territories were supported by higher CIs (0.68 and 0.61 respectively). These figures indicate that between 60% and 70% of resemblances among the textile designs associated with different Turkmen populations are consistent with a bifurcating tree model. One further study has published the Consistency Index of a cladogram obtained by cladistic analyses of material culture data: Jordan and Shennan's (2003) investigation into the diversification of Californian basketry traditions suggested that ethnogenesis played a more important role in generating resemblances between different populations than phylogenesis. An analysis of basketry data generated a cladogram with a much lower CI (0.35) than either the Turkmen textiles cladogram or the Iranian tribal crafts cladogram. Whereas both the latter were consistent with more than half of the resemblances between the taxa, the distributions of more than 60% of the Californian basketry traits conflicted with a bifurcating tree model. Based on these comparisons, it can be concluded that, overall, branching contributed more to the evolution of material culture variation among Iranian tribal populations than it did among Californian basket-weaving groups (Jordan and Shennan 2003), but was less dominant than in the Merzbach pottery (Collard and Shennan 2000) or Turkmen textiles (Tehrani and Collard 2002) cases.

Other investigations into processes of cultural diversification have addressed the phylogenesis/ethnogenesis problem in relation to the linguistic and geographical distributions of resemblances between cultural assemblages (e.g. Welsch et al. 1992; Moore and Romney 1994; Moore and Romney 1996; Collard and Shennan 2001; Guglielmino et al. 1995; Borgerhoff Mulder 2001; Hewlett et al. 2002). In these studies, phylogenesis is inferred when resemblances are closely correlated with linguistic relationships, while ethnogenesis is inferred when similarities are more consistent with geographical proximity. Analyses of material culture variation in New Guinea (Welsch et al. 1992; Moore and Romney 1994; Moore and Romney 1996; Collard and Shennan 2001) and the distributions of kinship and marriage traits in East Africa (Borgerhoff Mulder 2001) found that at least half the resemblances between different assemblages were consistent with linguistic patterns, suggesting they arose by descent, while the remainder are more likely to have resulted from borrowing between groups. This suggests that the balance between phylogenetic and ethnogenetic processes in generating Iranian tribal craft assemblages was similar to the East African and New Guinea cases. The influence of ethnogenesis was less pronounced in other studies of cultural variation in Africa (e.g. Guglielmino et al. 1995; Hewlett et al. 2002), which found that cultural similarities were much more strongly correlated with linguistic affiliations than with geographical proximity.

It should be noted, however, that, unlike the studies cited in the preceding paragraph, the analyses of the Iranian tribal crafts traits data did not directly address relationships between cultural patterns and linguistic/geographical patterns. Rather, it was assumed that cultural branching processes are likely to coincide with the bifurcation of ancestral population into new ones, whereas blending processes probably result from borrowings between neighbouring populations. If this assumption is correct, then it can be reasoned that the phylogeny obtained from the craft traits data should correlate with patterns of linguistic inheritance. However, contrary to these expectations, the phylogeny obtained from the craft traits data is only partially compatible with current assumptions regarding the groups' ethnic and linguistic affiliations (see Fig 2 and Table 1). One of the most obvious discrepancies between the craft phylogeny and linguistic patterns is that the former hypothesises that seven of the nine confederacies from which data were sampled share an exclusive common ancestor. Although the level of bootstrap support for this clade (89%) strongly indicates that these groups' craft traditions are related by descent from a common ancestral assemblage, this hypothesis is contradicted by their linguistic affiliations. Four of the groups speak Turkic languages (the Tekke, Yomut, Shahsevan and Qashqa'i), while three of them (the Bakhtiari, Papi and Boyer Ahmad) speak dialects of Lori, a Persian language. Two other Persian-speaking groups, (Talesh and Baluch), on the other hand, were excluded from the clade. Thus, contrary to the phylogenesis hypothesis, the craft traditions of the three Lori-speaking populations are more closely related to those associated with Turkic-speaking groups than they are to other Persian-speaking populations.

Although the origins of the largest clade cannot be accounted for by descent from a common ancestral population, the division of its seven constituent assemblages into two major lineages roughly corresponds to an ethno-linguistic divide between Turkic and Persian groups. The first lineage is represented by a clade comprising the Yomut and Tekke, who both speak Torkamani (or Turkmeni), and the Shahsevan, who speak Azeri, which like Turkmeni is associated with the Oghuz group of Turkic languages (Grimes 2002). This lineage included one sub-clade linking the Yomut and Tekke, which was extremely well supported by the bootstrap results (100%). The relationship between the Yomut and Tekke craft assemblages is congruent with both linguistic and ethnohistorical data. As mentioned previously, the Yomut and Tekke speak closely related dialects of Turkmeni (Dulling 1962; Grimes 2002; Agadzhanov & Karryev 1978). According to the tribes' own genealogies, both are descended from an Oghuz Turkic tribe and emerged as independent entities in the 17th century (Barthold 1962; Wood 1990). Although the Shahsevan also belong to an Oghuz Turkic lineage, they are linguistically distinguished from the Turkmen, speaking a dialect of Azeri which is similar to that spoken in the Qashqa'i confederacy (Tapper 1997, Amir-Moez 2002). Thus the similarities between the Turkic-speaking groups included in this clade are mostly consistent with their ethnic/linguistic affiliations and probably arose by descent from a common ancestral population.

The second major lineage is represented by a clade that comprises four groups, including the Bakhtiari, Papi Lor and Boyer Ahmadi Lor. These groups all speak dialects of Lori, an Iranian language related to Farsi (Grimes 2002). The first two groups comprise a sub-clade from which the Boyer Ahmad Lor were excluded, although bootstrap support for this hypothesis was weak (53%) and there is no linguistic evidence to support a closer relationship between the Bakhtiari and the Papi Lor. Nevertheless, it can be hypothesised that resemblances between the Boyer Ahmad, Papi and Bakhtiari assemblages were probably inherited from a common ancestral population. However, the lineage also includes the Turkic Azeri-speaking Qashqa'i while excluding the Talesh and Baluch, who speak Iranian languages that are related to the Lori dialects spoken by the Bakhtiari, Papi and Boyer Ahmad. There are two possible explanations for the origins of this lineage. The first interpretation is that the Bakhtiari, Boyer Ahmadi and Papi assemblages are mostly 'descended' from the Qashqa'i, who also inhabit the Zagros mountain range (see map, Fig. 1). This explanation would account for the inclusion of the former three groups in the most inclusive clade returned by the analyses, which otherwise consists of assemblages associated with Turkic-speaking confederacies and excludes the Talesh and Baluch.

However, were this explanation correct, then the clade comprising the Qashqa'i and Lor-speaking groups' assemblages would be expected to cluster with the Shahsevan assemblage. Moreover, there is strong evidence that the Qashqa'i have adopted traits from their Lor-speaking neighbours, such as the black goat-hair tent which is associated with the latter (Fig. 8). Since other Turkic groups, including the Shahsevan, Tekke and Yomut use the heavier, round felt tent supported by wooden frames, it is reasonable to conclude that this particular artefact was acquired by the Qashqa'i from non-Turkic neighbouring groups. One means through which the Qashqa'i might have acquired traits from neighbouring populations is suggested by ethnohistorical accounts relating to the growth of the Qashqa'i confederacy in the 18th century, which partially occurred through the assimilation of small populations of Lor-speakers (Barth 1961, Beck 1986). However, since non-Turkic groups constituted a small minority of the confederacy's total population, this explanation cannot entirely account for the relationships between the Qashqa'i neighbouring groups' craft traditions. It seems likely that many of the similarities between the weavings of the Qashqa'i, Bakhtiari, Boyer Ahmad and Papi probably arose through the circulation of craft skills and designs through borrowing between neighbouring groups in this region. For example, it is believed (e.g. Baker 1995) that many of the designs used by these groups today originated among the Kashkuli tribe (of the Qashqa'i confederacy), and were acquired during the 20th century. This hypothesis is based on the fact that carpets made in the 19th century do not exhibit these designs, except for those produced by Kashkuli weavers (Baker 1995). It is also noteworthy that, contrary to the phylogenesis hypothesis, cultural exchanges between groups in the region do not appear to have been inhibited by language barriers, endogamy or by conflicts arising from disputes over water, pasture and migration routes, which ethnographic reports suggest were quite frequent (Beck 1986; 1991; Amir-Moez 2002). Although these barriers might be expected to act as Transmission Isolating Mechanisms (e.g. Durham 1990, 1992), it appears that Qashqa'i, Bakhtiari, Papi and Boyer Ahmad craft traditions comprise a regional 'community of culture' (Jordan and Shennan 2003), evolving partly through branching and partly by blending and borrowing.

Fig 8: Qashqa'i goat-hair tent (above) and Shahsevan felt tent (below). (After Thompson and Tapper 2002). The latter is type is believed to be primitive to Turkic-speaking groups, suggesting that the Qashqa'i acquired the techniques for making goat-hair tents from neighbouring Persian-speaking groups, probably because they are more suited to the local ecology.

It is possible that the other relationships suggested in the craft phylogeny might also be conceived of as 'communities of culture', since the clades linking the Turkmeni-speaking Tekke and Yomut and the Lor-speaking Bakhtiari, Papi and Boyer Ahmadi, also express regional groupings. Although the relationships between these groups' craft assemblages are consistent with their linguistic relationships, and can therefore be explained by descent from ancestral populations, it should be noted that in the two cases where linguistically related groups are geographically distant, the analyses of the crafts trait data did not return phylogenetic hypotheses linking their assemblages. The first case, described above, is the Qashqa'i and Shahsevan, who speak closely related dialects of Azeri, but inhabit different regions of Iran (see map on Fig. 1 and language phylogeny on Fig. 2). While the Shahsevan assemblage grouped with assemblages associated with less closely related populations (the Turkmeni-speaking Yomut and Turkmen), the Qashqa'i assemblage was included in a clade with unrelated, but geographically proximate Lor-speaking groups' assemblages.

The second case is the Talesh and Baluch. Both these groups speak languages affiliated to the North West Iranian family, and ethnohistorical evidence suggests that the Baluch migrated from the Caspian basin, where the Talesh are still based, to their current territories of Baluchistan in south-eastern Iran and Pakistan some 900 years ago (Salzman 2000; Thompson 2002). Given the lack of evidence, it cannot be assumed that, prior to their re-location, the ancestors of the Baluch wove carpets and other textiles, nor that their weavings were similar or somehow related to those of the ancestors of the Talesh. However, even if this was the case, it seems that any phylogenetic trace linking the two groups' assemblages today has been erased over the centuries as a consequence of their isolation from one another, the development of new traditions and possibly also transmission with neighbouring groups. In contrast, both the Yomut and Tekke Turkmen and the Lor-speaking Bakhtiari, Boyer Ahmad and Papi tribes have remained regionally well-defined groups. Although the resemblances between these groups' assemblages are consistent with linguistic patterns and might be explained by inheritance from ancestral populations, the two cases mentioned here suggest that geographical proximity is likely to have also been an important factor in maintaining the relationships between these groups' craft traditions. In support of this, one researcher who has carried out extensive fieldwork among the Bakhtiari has reported that the characteristic *choogha* (Fig. 9) worn by Bakhtiari men as a sort of tribal uniform, was actually adopted from the Papi Lor in the early 20th century (Digard 2002). Thus, it can be hypothesised that the craft traditions of the Bakhtiari and Papi are probably linked by both descent from a common ancestral population and by cultural exchanges that have occurred subsequent to their emergence as separate social entities.

Fig 9: Bakhtiari man wearing the choogha. *(Photographed in July 2002). Although this woven cloak is now worn as a tribal uniform by Bakhtiari men, it is believed to originate in the neighbouring Papi tribal confederacy.*

On the other hand, it should also be emphasised that the results of the present analysis indicate that geographical proximity and contact between populations are not a sufficient basis for the formation of 'communities of culture'. For example, the Persian-speaking Talesh, whose craft traditions are apparently unrelated to those of the linguistically similar but geographically distant Baluch tribe, are close neighbours of the Turkish-speaking Shahsevan and share some political and economic links with them (Bazin 1980, 1982; Tapper – personal communication). However, the results of the analyses suggest that the Talesh assemblage is no more related to the Shahsevan assemblage than it is to any other, and does not share a substantial number of similar traits with the latter. The Shahsevan, on the other hand, were grouped with two other Turkic-speaking populations (the Yomut and Tekke) from whom they are geographically isolated. Moreover, this clade was quite strongly supported by the results of the bootstrap analysis (occurring in 61% of the bootstrap cladograms). Thus, the geographical proximity of the Shahsevan and Talesh does not appear to have significantly influenced the development of their craft traditions. Therefore, although the analyses of the craft traits data failed to support phylogenetic hypotheses linking linguistically-related but geographically distant populations (namely, the Shahsevan and Qashqa'i and Talesh and Baluch), the relationships suggested by the cladogram should not be interpreted as representing regional groupings only. Instead, most of the clades returned by the analyses comprise populations who are linked by both common ancestry *and* geographical proximity. Although the inclusion of the Turkic-speaking Qashqa'i in a clade with Lor-speaking groups might represent an exception to this general rule, even in this case it should be recalled that some of the groups comprising the Qashqa'i confederacy are of Lori origin (Barth 1961; Beck 1986). Therefore, even in this case, there is reason to believe that both descent and transmission between neighbouring groups were involved in generating the relationships suggested by the craft phylogeny.

To conclude, it would appear that patterns of material culture variation among Iranian tribal populations are not entirely consistent with either the phylogenesis hypothesis or the ethnogenesis hypothesis. Firstly, the results of cladistic analyses of a data set comprising 110 craft traits sampled from nine populations indicated that resemblances between the material culture assemblages were generated by both branching and blending. Secondly, comparison between the craft cladogram and the groups' linguistic relationships and geographical distributions suggested that relationships between the assemblages probably arose partly by descent from ancestral populations and partly through borrowing between neighbouring groups. The chapters that follow will explore the relative contributions of these processes in more detail, assessing whether they can be more accurately accounted for by alternative models of cultural diversification, namely the 'core traditions' hypothesis and 'multiple packages' hypothesis. Both hypotheses propose that different mechanisms of cultural learning might generate long-lasting and coherent cultural traditions for some traits, while allowing for borrowing and blending among others. These possibilities will be investigated through further analyses of the tribal crafts data, and in relation to qualitative data on craft learning collected through ethnographic fieldwork among tribal communities in Iran.

CHAPTER 4

Core Traditions? An Investigation into the Transmission of Craft Skills and Craft Designs

4.1 Introduction

In this chapter, patterns of cultural inheritance in Iranian tribal craft assemblages are investigated in relation to the 'core traditions' hypothesis (e.g. Rosenberg 1994; Boyd et al. 1997; Shennan 2002). This hypothesis represents an intermediate position in the phylogenesis/ethnogenesis debate. It proposes that cultures are constituted by "hierarchically integrated systems" (Boyd et al. 1997, Rosenberg 1994) which evolve through both phylogenetic and reticulate processes, with each process affecting a separate class of socially transmitted information. 'Cultural cores' comprise a relatively cohesive set of traits that are insulated from external influences and remain stable in their transmission from one generation of social learners to the next. Traits belonging to 'cultural peripheries', on the other hand, are susceptible to extensive reticulation and replacement. Whereas core traits represent the ancestral relations shared among a group of cultural assemblages, peripheral traits reflect the interaction of cultural traditions associated with neighbouring societies. As such, the distribution of core traits and peripheral traits in the Iranian tribal crafts data would be expected to coincide with the distributions of homologies and homoplasies, respectively. Furthermore, core lineages are likely to correlate with population histories and linguistic patterns, whereas the transmission of peripheral traits probably transcends linguistic and social barriers.

These predictions were tested by dividing the tribal crafts traits into two categories: 'technical' traits, which relate to the specific weaving skills used to manufacture textiles, and 'decorative' traits, comprising designs, patterns and motifs. Ethnographic data on craft transmission suggest that there is reason to believe that these categories corresponds to the theoretical characterisation of a cultural core and periphery respectively (e.g. Rosenberg 1994;

Boyd et al. 1997). Separate analyses of the traits belonging to each category investigated whether the distribution of shared technical traits among the tribal assemblages was more consistent with a phylogenetic tree compared to the distribution of shared decorative traits. Discussion of the results of the analyses will focus on whether cultural phylogenies can be reconstructed more accurately by identifying core traits, and the extent to which the transmission of core traits fit linguistic and ethnohistorical data better than the transmission of peripheral traits does.

4.2 Materials and Methods

It is important to stress that the identification of core and peripheral traits should be independent from the methods used to distinguish between traits arising by descent (homologies) and those arising from other processes (homoplasies). This is because the core and periphery hypothesis not only predicts a role for both phylogenetic and reticulate processes in cultural evolution, but specifically states that the influence of each process is delimited by the organisation of cultural knowledge into a 'hierarchically integrated system' (Boyd et al. 1997). This system involves the maintenance of a stable set of so-called 'core' traits while allowing for the adoption and replacement of 'peripheral' traits. In other words, demonstrating that both phylogenesis and ethnogenesis contributed to the evolution of a group of cultural assemblages does not in itself vindicate the claims made by the core and periphery hypothesis. It would be inadequate to simply equate homologies with core traits and homoplasies with peripheral traits *a priori*, because this would render any hypothesis concerning correlations between these categories untestable. Accordingly, the approach taken here seeks to relate the theoretical concepts of the core and periphery hypothesis to empirical distinctions concerning the way different craft traits are learned and transmitted.

Based on ethnographic data on craft learning among Iranian tribal populations and the categories employed by textile experts to identify weavings, two types of traits were identified that could potentially be distinguished from one another in terms of the core and periphery paradigm: The first are referred to here as 'technical' traits and represent the specific weaving skills associated with structural characteristics of the tribes' textile products, such as pile-knotting, tapestry techniques and processing raw materials. The second are referred to as 'decorative' traits and comprise the individual designs, ornaments and motifs that are used in tribal textile patterns.

Observation of craft learning and semi-structured interviews carried out during several field visits to tribal communities in western and south-western Iran between June 2001 and August 2003 revealed that technical traits are generally learned by weavers at an early age (5 – 10 years old), and are usually transmitted from mother to daughter. Young Qashqa'i, Boyer Ahmad Lor and Bakhtiari girls were observed assisting their mothers spinning wool and weaving crude patterns on miniature looms before graduating to full-size looms to weave carpets, initially as assistants and eventually independently. Similar learning processes have been reported among other tribal groups, such as the Yomut Turkmen (Irons 1980, 1990) (Fig 10). Weavers from Bakhtiari, Boyer Ahmad and Qashqa'i communities reported that the skills of spinning and plying wool, loom construction, knotting and finishing require up to two or more years of regular practice to master. It was also reported that new techniques learned through individual experimentation, or exposure to the craftsmanship of other weavers, are rarely acquired in adulthood. The apparent coherence of technical traits, and their stability through time, is further suggested by the fact that oriental textile experts tend to base the attribution of both antique and modern weavings to specific groups according to associations of specific structural features (e.g. Thompson 1980, Bogolyubov 1973, Eiland 1981, Housego 1978, Parham 1996). These include the tension of the warp, the type of knot employed to tie pile knots, the number of weft yarns used between each row of knots, flat-woven tapestry techniques, and the method used to secure the ends of textiles (finishing).

Fig 10: Yomut mother and daughter weaving a carpet together (Irons 1980). Young girls learn most textile-making techniques by collaborating with and observing their mothers at the loom. Here, the mother is clipping excess pile yarns to create an even surface.

Weavers in these communities also begin learning designs from their mothers at an early age. However, unlike technical traits, they continue learning them throughout their lives and do so from several different potential sources. Initially, weavers use basic geometric designs to decorate their textiles, but as they become more accomplished they begin to use patterns of increasing complexity. New designs can be acquired by copying directly from other weavers, indirectly from patterns seen on other textiles, and from 'cartoons' (knot-by-knot templates) of urban and courtly carpets provided by *bazaari* (merchants) from nearby towns and cities (Fig. 11). They are also learned through employment in workshops. Decorative traits are adopted, replaced and experimented with so frequently that textile scholars acknowledge that making attributions of provenance based solely on the design features of a textile product is notoriously difficult (Thompson 1983, Opie 1992). For example, one group of antique tribal carpets that have been identified as Qashqa'i based on dye analysis and structural characteristics use a classical prayer rug design that is known to be of an urban, courtly origin (Opie 1992; Parham 1996; Housego 1978). There is also evidence of designs migrating between tribes, as shown in the case of the Yomut Turkmens' recent adoption of the 'Tekke gul' carpet ornament which, as the name implies, is historically associated with the Tekke Turkmen (Thompson 1980). The weavings of these two tribes, however, continue to be distinguished by structural features: The Yomut use symmetrical pile knots, while the Tekke use asymmetrical knots.

Fig 11: A Qashqa'i mother and daughter copying designs from a 'cartoon' (Photographed in July 2001). The cartoon provides a knot-by-knot template for the design of a carpet. Many new designs have been introduced into traditional design repertoires through cartoons provided by rug merchants based in nearby cities, such as Shiraz, which borders the Qashqa'i territories (see map on Fig.4).

These examples suggest that Iranian tribal textile assemblages can therefore be reasonably thought to consist of a durable core of associated structural characteristics, and a less stable periphery of design features. The extent to which traits associated with these categories have evolved in the manner predicted by the core and periphery hypothesis was tested by preparing two data sets for cladistic analysis. Using the sample of textiles described in the previous chapter, the first data set comprised nine in-group taxa, each representing the craft assemblage associated with one of the tribal populations included in the sample: the Tekke and Yomut Turkmen, the Shahsevan, Qashqa'i, Bakhtiari, Boyer Ahmad and Papi Lor, the Talesh and Baluch. The presence or absence of 55 technical characters in each taxon was recorded in a matrix (Table A4, Appendix A). These characters included the manufacture of particular artefacts (e.g. tent cloth, saddle bags, items of clothing etc.), the skills used to make them (e.g. flat-weaving, pile-knotting, spinning, plying etc.), and variations in technique (e.g. different types of knot, brocading, finishing etc.). The second data set comprised the same nine in-group taxa, and 55 decorative characters representing variations in designs, motifs and patterns. The presence or absence of each character in each taxon was encoded in a matrix (Table A5, Appendix A).

Both sets of data were analysed in PAUP 4.0* (Swofford 1998), with the Arab Bedouin once again employed as an outgroup. Firstly, a branch and bound search identified the most parsimonious cladogram for the technical traits data and decorative traits data respectively. As explained previously, the cladograms obtained from each data-set represents the best explanation of shared characters based on a null model in which new taxa arise by the bifurcation of ancestral taxa. The fit between data sets and the bifurcating tree model was then assessed in relation to the Consistency Index (CI) of the optimal cladograms obtained for each, and with bootstrapping. A close fit would indicate that most of the similarities among the assemblages are homologous, and derive from shared ancestry. A poor fit between the data and the tree model would suggest that the distributions of a large number of shared traits require additional hypotheses, and can be classified as homoplastic. Based on the results of these two measures for the technical traits data and decorative traits data, it is possible to compare the extent to which each fits the bifurcating tree model. Following the logic outlined in the previous chapter, it is then possible to infer the relative contributions of branching and blending processes to the evolution of the tribal craft assemblages in relation to weaving techniques/skills and designs respectively.

4.3 Hypotheses and Predictions

According to the 'core traditions' hypothesis, core traits are expected to change very slowly and associations among them conserved over long periods of time. Owing to these qualities, it has further been claimed that core traits can be used to reconstruct cultural phylogenies (Boyd et al. 1997) as they are usually inherited as a single unit from ancestral entities by descendent entities. Associations between peripheral traits, on the other hand, are believed to be more capricious, since they can be transferred between contemporaneous groups on an individual basis and are subject to rapid change through time. These predictions were tested for Iranian tribal craft assemblages using the results of the technical traits and decorative traits analyses. Based on ethnographic evidence and the oriental textile literature, technical traits, relating to specific skills and the manufacture of particular types of artefact, were identified as potentially comprising the 'cultural core' of the textile assemblages. Decorative traits such as designs, patterns and motifs were identified as the likely 'periphery'. Based on the core and periphery hypothesis, we can predict that the distribution of technical traits should be largely homologous and fit well with the bifurcating tree model used to represent cultural phylogenies. The evolution of decorative traits, on the other hand, is expected to be less simple, with a more homoplastic distribution of shared characters among the taxa.

If the hypothesis is correct, the CI of the technical traits data should be higher than 0.54, the CI of the optimal cladogram returned by the analysis of the data set described in the previous chapter, which comprised all the craft traits recorded for the tribal assemblages. The CI of the cladogram for the decorative traits data set, on the other hand, should be lower than 0.54. Based on this comparison between the CIs for each of cladogram, it is possible to assess the extent to which the distribution of homologies and homoplasies in the original data coincides with the classification of technical and decorative traits as 'core' and 'peripheral' traits respectively. Likewise, the bootstrap percentages for the clades comprising the technical traits' cladogram should be significantly higher than those for the decorative traits and the original data set comprising all craft traits. If so, it can be reasoned that the identification of core traits provides a basis for reconstructing cultural phylogenies (e.g. Boyd et al. 1997). The corollary of this claim – that peripheral traits are often transmitted individually between groups and tend to reflect the history of contact, rather than descent – should on the other hand be reflected in poorly supported clades for the decorative traits cladogram.

4.4 Results

The branch-and-bound search of the technical traits data set returned one cladogram, representing the most parsimonious explanation for the distribution of shared characters based on the bifurcating tree model. The length of the shortest cladogram obtained from the technical traits data was 85. A single cladogram was also returned from a branch-and-bound analysis of the decorative traits cladogram. This cladogram was longer than the most parsimonious technical traits cladogram, measuring 99. Although both this cladogram and the technical traits cladogram are much shorter than the cladograms returned by the analyses carried out in the previous chapter (188 and 173 respectively), the latter were obtained from a much larger data set, which included 110 characters rather than 55 (and therefore required a greater number of hypotheses of character-state changes to account for conflict among the distributions of resemblances among the assemblages). The cladograms obtained by bootstrap analyses of both sets of data are shown in Figures 12 and 13. These analyses returned a slightly longer tree for the technical traits (length = 86, a difference of only +1) and a shorter tree for the decorative traits data (length = 94, again a small difference of -5). Like the bootstrap analysis of the aggregated craft traits data, the results of the bootstrap analysis of the technical traits data excluded the Talesh and Baluch from the ingroup clade. However, unlike the former analysis, the bootstrap analysis suggested that although the Talesh and Baluch are not linked to any other group, they are related to one another: 55% of the bootstrap cladograms supported an exclusive common ancestor for the techniques employed by the Talesh and Baluch. The other relationships identified in the cladogram (Fig 12) were almost identical to those returned by the bootstrap analysis of the original craft traits data set, although, overall, the technical traits data yields clades that were more strongly supported than the former. Four of the seven clades returned by the bootstrap analysis of the technical traits data were supported by 60% or more of bootstrap clades. In the bootstrap analysis of the original craft traits data set, only five clades were returned, three of which were supported at or above 60%. One anomaly should be noted: the most inclusive clade (comprising all the ingroup taxa except the Talesh and Baluch) in the crafts data set was supported by 89% of bootstrap clades while the equivalent clade in the technical traits cladogram was more modestly supported by 68% of the bootstrap cladograms. On the other hand, the clade comprising the Qashqa'i, Boyer Ahmad, Papi and Bakhtiari taxa is far more strongly supported in the technical traits cladogram than the original craft traits cladogram. The former was represented in 77% of the bootstrap clades, compared to 59% in the latter. Moreover, the relationships among these assemblages is more resolved in the technical traits cladogram than in the craft traits cladogram. In the latter there is a trichotomous split in the lineage with only one sub-clade, comprising the Papi Lor and Bakhtiari with 53% support. In the technical traits cladogram, the Papi-Bakhtiari subclade is retained with slightly higher support (55%), but is embedded within another clade linking them to the Boyer Ahmadi Lor to the exclusion of the Qashqa'i, which had the support of 64% of the clades generated from the bootstrap analysis.

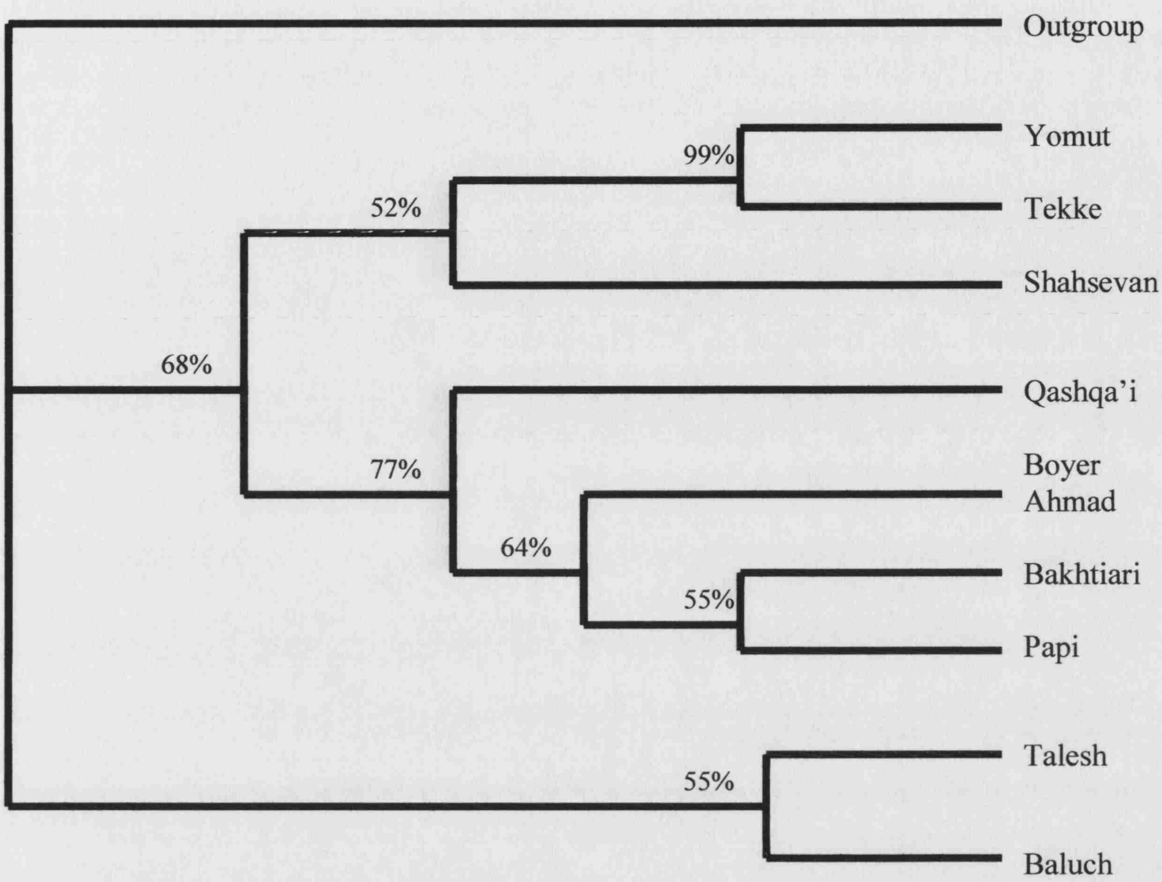


Fig 12: The phylogeny obtained from analyses of the technical traits data set. The bootstrap support values for each of the branches represented in the tree are shown beside each node, ranging from 52% - 99%. The strength of the bootstrap support values and the Consistency Index (0.58) of the tree indicate that branching processes dominated the evolution of tribal weaving techniques – although blending also played a significant role. Therefore, these results are only partly compatible with the hypothesis that weaving techniques represent a 'core tradition' that is transmitted by descent, changes slowly and is resistant to the introduction of novel traits.

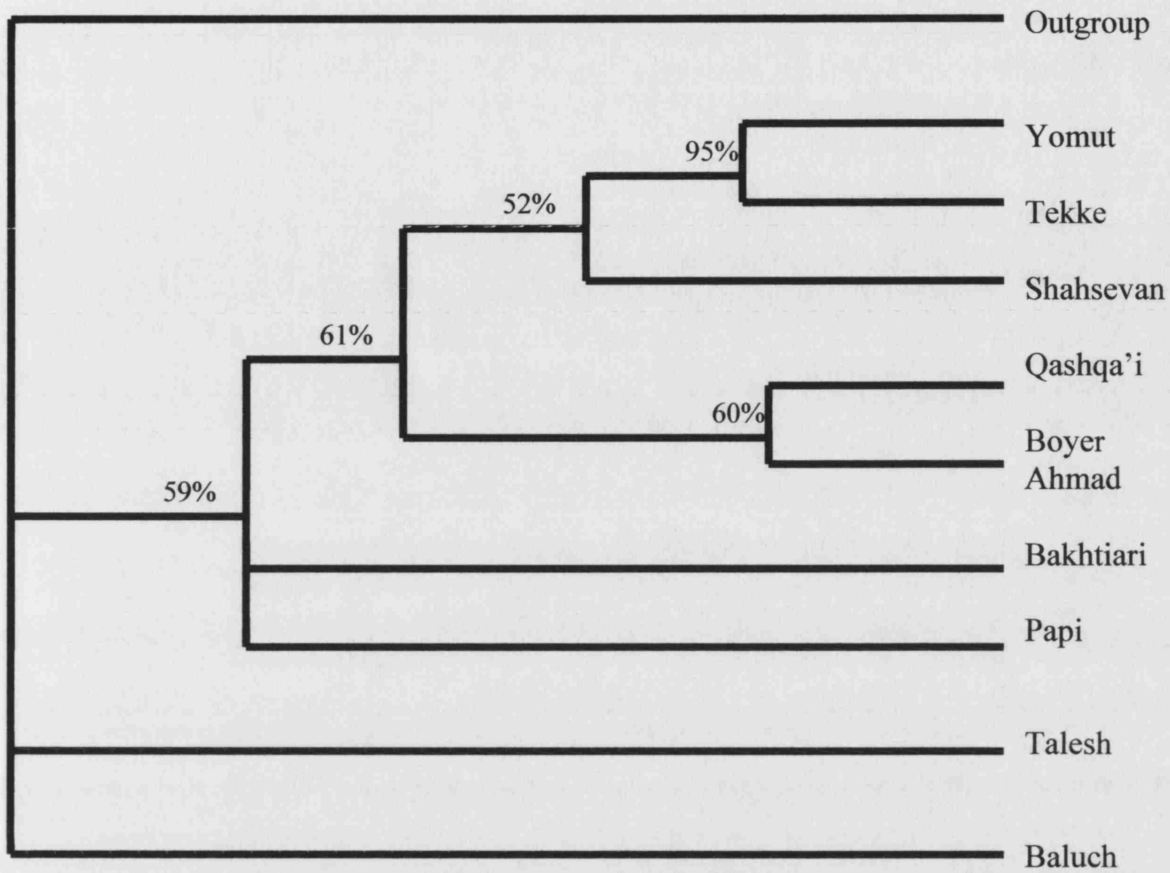


Fig 13: Phylogeny obtained from analyses of the decorative traits data set, with bootstrap support values represented in the nodes of the branches (range = 52% - 95%). As predicted by the 'core traditions' hypothesis, these results suggest that the phylogenetic signal in this data set was weaker than in the technical traits data set, since the analyses returned fewer clades than the analyses of the technical traits data did (Fig 11).However, the difference in the Consistency Indicies (0.58 and 0.52) and range of bootstrap support values for each tree was less pronounced than expected. According to the 'core traditions' hypothesis, 'peripheral' traits change rapidly and are subject to extensive replacement and borrowing. Therefore, the evolution of decorative traits does not appear to fit the characterisation of a 'cultural periphery' since it was mainly influenced by descent – although less so than technical traits.

Bootstrap analyses of the decorative traits data returned five clades (Fig. 13), only three of which were supported by 60% or more of the clades generated from the resampled data. The lower resolution of the decorative traits cladogram indicates a higher number of homoplasies in this data set than in the aggregated crafts traits data set and technical traits data set, as predicted by the core and periphery hypothesis. However, as was the case for both the other cladograms, the strongest supported clade comprised the Yomut and Tekke Turkmen, which at 95% was only slightly less well supported than in the aggregated craft traits cladogram (100%) and technical traits cladogram (99%). Among these Turkmen tribes, therefore, phylogenesis was almost as dominant in generating resemblances among designs as it was among techniques, meaning that the former do not comprise a fluid, unstable periphery in the groups' craft assemblages. On the other hand, the most inclusive clade represented in the decorative traits cladogram, which comprised all the taxa to the exclusion of the Talesh and Baluch, was less well supported than its equivalents in the other cladograms, with only 59% (compared to 89% and 68% respectively). The three remaining clades comprised a lineage incorporating two subclades: the Yomut, Tekke, Shahsevan; and the Qashqa'i and Boyer Ahmad. The lineage was supported by 61% of the bootstrap cladograms, while the two sub-clades enjoyed support of 52% and 60% respectively. The grouping of the Persian-speaking Boyer Ahamdi Lor with the Turkic-speaking Qashqa'i in a lineage also comprising the Turkic-speaking Yomut, Tekke and Shahsevan is particularly noteworthy. It represents a reversal of the grouping of the Qashqa'i with the Persian-speaking Boyer Ahmad, Bakhtiari and Papi taxa in the technical traits cladogram. This conflict, which suggests complex and contradictory origins for these textile assemblages, is reflected on in detail in the following discussion.

The Consistency Index (CI) for the two cladograms differs significantly, though not as dramatically as the core and periphery hypothesis predicted. The cladogram returned by the analysis of the technical traits data set has a CI of 0.58. The CI of the cladogram generated from the decorative traits data is 0.52. Therefore, as predicted by the Core and Periphery Hypothesis, the CI of the technical traits cladogram is higher than the CI of 0.54 measured for the cladogram returned by the analysis of all the craft traits described in the previous chapter, while the CI of the decorative traits cladogram is lower than that figure. However, the difference between the CI measures (0.06) is not sufficient to conclude that technical traits comprise a cultural core that evolved by lineage-splitting while resemblances among decorative traits arose by borrowing and blending. It is clear that phylogenesis and ethnogenesis have both influenced the evolution of technical and decorative features of Iranian tribal textile assemblages. This lends support to the alternative hypothesis that the effects of phylogenetic and ethnogenetic processes on the evolution of technical and decorative traits are more generalised. Nonetheless, the difference between the CI measures of the two cladograms, although modest, does suggest that coherent units of descent are more likely to develop among technical traits than among decorative traits, a notably higher percentage of which seem to have been adopted as a result of horizontal transmission processes.

4.5 Discussion

Overall, the results of the bootstrap analyses and the Consistency Index measures offer limited support to the core and periphery hypothesis. As predicted by the hypothesis, the technical traits cladogram (CI = 0.58) is more parsimonious than the original crafts traits cladogram (CI = 0.54), while the decorative traits cladogram (CI = 0.52) is less parsimonious than the crafts traits cladogram. This demonstrates that, compared to the distributions of technical traits, a higher proportion of similar decorative traits are homoplastic. This supports the idea that technical traits comprise a relatively coherent core that was more protected from horizontal transmission and blending processes than the decorative traits were. However, this endorsement of the core and periphery hypothesis is a qualified one. Although phylogenetic processes were more influential in generating resemblances among technical traits than among decorative traits, the difference is marginal: The CI measures for the two cladograms indicate a substantial number of homoplasies in the technical traits data set, while over half the resemblances among the decorative traits are in fact consistent with a bifurcating tree pattern, which suggests the majority arose by descent from ancestral assemblages.

Although this ambiguity is echoed by the results of the bootstrap analyses, nevertheless the technical traits data returned seven clades, four of which were supported by more than 60% of the clades generated from the resampled sub-sets of the data. By contrast, bootstrap analyses of the original data set and the decorative traits data set both returned five clades, only three of which enjoyed support of 60% or higher. These results thus demonstrate that the removal of decorative traits from the crafts traits data results in more nesting among the taxa represented in the phylogeny, and thus resolves some of the more ambiguous relationships discussed in Chapter 4. For example, analyses of the original crafts traits data returned a clade linking the Qashqa'i, Boyer Ahmadi Lor, Papi Lor and Bakhtiari assemblages, with one sub-clade hypothesising a closer relationship between the latter two taxa. Both clades were retained in the cladogram returned by the technical traits data. However, the Papi Lor-Bakhtiari sub-clade was embedded within another sub-clade which hypothesised a common ancestor shared between these groups and the Boyer Ahmadi Lor, to the exclusion of the Qashqa'i. The more hierarchical arrangement of these relationships indicates that patterns in the technical traits data set are more tree-like than the original data set, which also included decorative traits. Moreover, in this case it seems that resemblances among the groups' weaving techniques are consistent with linguistic similarities (Table 1), since the Bakhtiari, Papi and Boyer Ahmad speak closely related dialects of Lori, a Persian language, whereas the Qashqa'i speak Azeri, a Turkic language. This indicates that, among the Lor-speaking groups, the transmission of weaving skills is broadly similar to linguistic transmission. There is evidence that associations between technical traits and linguistic patterns can endure over long time periods, as suggested by the case of the Talesh and Baluch. The Talesh and Baluch speak related dialects, both belonging in the category of North-Western Persian languages. In the analyses of the original crafts traits data set, no phylogenetic hypothesis regarding the relationship between these two assemblages could be determined. However, in the technical traits cladogram, the two assemblages are linked in a clade which appeared in more than half (55%) of the bootstrap cladograms, suggesting that the majority of techniques used by both groups were inherited from a common ancestral assemblage. This result is remarkable given that a putative common ancestor for the two populations would have had to have existed prior to the migration of the Baluch's forebears south-east more than 900 years ago (Thompson 2002). Since the Talesh and Baluch are separated by more than 1000km, it is also highly unlikely that horizontal transmission has contributed to resemblances among their weaving techniques. Although it was suggested in the previous chapter that continued contact between phylogenetically related populations was probably an important factor in maintaining similarities among their craft assemblages, this case suggests that the coherence of technical traits can be sustained even in the absence of such interactions.

One potential explanation for the durability of weaving techniques is that the time and effort required to learn them restricts transmission between unrelated individuals and groups. Shennan and Steele's (1999) survey of craft learning in the ethnographic record suggested that craft skills are usually transmitted between a parent to a child of the same sex. They explain this pattern in relation to the theory of 'inclusive fitness' (Hamilton 1964), which states that co-operation between related individuals can be understood as a strategy for maximising both parties' reproductive success. However, it is difficult to test this hypothesis in societies where craft production is carried out by most members of the community, especially when detailed information on the other factors (status, wealth, health, etc.) that contribute to individual fitness is lacking. A more fruitful interpretation of the costs of craft learning and their impact on cultural evolution is suggested by Petrequin and Petrequin's (1999) ethnoarchaeological study of pottery-making in New Guinea. They focus on the remarkably durable distinction between the pottery techniques used by Austronesian-speaking populations and those employed by non-Austronesian speakers. Whereas Austronesian-speakers use 'paddle and anvil' construction techniques to build vessels, the non-Austronesian populations use coil construction methods, finishing with paddle and anvil. Although these populations are close neighbours and exchanged other cultural traits, this apparently did not result in the borrowing and blending of these pottery-making techniques. Petrequin and Petrequin explain this in relation to cognitive constraints on the transmission of craft skills that reduce the likelihood of reticulation taking place between neighbouring populations of social learners. They suggest that pottery vessel construction involves a set of highly practised motor-skills which, once mastered, are resistant to re-modelling.

An example of such a constraint in craft learning among Iranian tribes is suggested by pile-knotting techniques in the manufacture of carpets. The weavings of Turkmen tribes – for which there is a longer record of weaving than any of the other tribes – suggests that pile-knotting techniques can remain stable over hundreds of years (Thompson 1989). Interviews and observations of Bakhtiari and Qashqa'i craftswomen revealed that the skill of looping a pile yarn around two warp threads with fluency is very difficult to acquire, and requires a great deal of coordination of the fingers. In my experiments with pile-knotting, after some practise I was able to complete a row of six knots in a minute, which is presumably about average for a non-expert. Accomplished tribeswomen were able to weave more than fifty knots in a minute. More remarkably still, I commonly observed women weaving at this rate whilst chatting, singing, and keeping an eye on babies and young children, apparently not needing to concentrate on their work. In one case, I observed an elderly tribeswoman weaving a *gelim* (a flat-woven carpet) even though she was actually blind and had to rely purely on motor-memory.

Cognitive anthropologists (e.g. Strauss & Quinn 1997; Bloch 1998) refer to activities such as this as 'practical knowledge'. Practical knowledge consists of mental schemata that are dedicated to the performance of specific tasks. They are acquired and maintained through constant repetition and do not require the individual to 'think about what they're doing'. While ethnographic descriptions have largely concentrated on the linguistic sphere of cultural knowledge - such as narratives and ideologies - cognitive anthropologists have highlighted the ways in which much of our cultural behaviour, from ritual to every day activities such as car-driving and typing, is performed in an almost automatic, instinctive manner. This is because the performance of these activities does not require an individual to consciously retrieve the instructions for the behaviour in a linear, sentence-like way. Rather, the use of practical knowledge is akin to the operation of parallel processing in computers, in which information is analysed simultaneously using pre-existing networks that connect the processors at a much faster rate than would be possible using a single processor (Bloch 1998). However, as this analogy suggests, once the connections between the various components of an activity are established, it is difficult to break them down and create new ones. In the case of pile-knotting, it is noteworthy that of the two different types of knot (symmetrical and asymmetrical) that were recorded in the sample, only one population used both, the Qashqa'i. Given that each knot has its advantages, it may seem surprising that the asymmetrical knot, which can produce finer designs, and the symmetrical knot, which produces more hard-wearing textiles, have not both spread throughout the region. Consequently, it can be reasoned that, as Petrequin and Petrequin (1999) argue in relation to new Guinea pottery techniques, the cognitive processes involved in developing the motor-skills repertoire for pile-knotting act as a constraint on adopting new methods.

It seems feasible, therefore, that the transmission of a linked set, or 'core', of technical traits is based on, and protected by, the processes by which 'practical knowledge' is acquired. Nonetheless, the fit between the technical traits data and a bifurcating tree was far from perfect, nor the fit between the tree and the linguistic data. This suggests that the origins of linked sets of technical traits are more complex than a simplistic concept of 'culture birth' in which language and core traits are inherited from a single ancestral population. The Qashqa'i represent a particularly problematic case in this respect. As noted previously, the technical traits data returned a clade linking the Qashqa'i assemblage to the Boyer Ahmadi Lor, Papi Lor and Bakhtiari assemblages. As noted previously, the Qashqa'i speak a Turkic Azeri dialect, whereas the Papi, Boyer Ahmad and Bakhtiari all speak Persian Lori dialects. The inclusion of the Qashqa'i in a clade comprising Lori-speakers (rather than one comprising other Turkic speakers and, in particular, the Azeri-speaking Shahsevan) suggests that the Turkic populations which settled in the Zagros region and gave rise to the Qashqa'i Confederacy in the 18th century adopted the majority of their weaving techniques from local populations. This may have partially occurred through the assimilation of various Lor and other indigenous Persian-speaking elements, (Barth

1969; Beck 1986; Amir-Moez 2002), but probably also involved borrowings. In any case, the diffusion of the craft skills associated with these populations throughout the tribe's territories seem to have resulted in the replacement of Turkic techniques, rather than blending with them. There are some exceptions to this, such as case of pile-knotting techniques mentioned above. Both symmetrical and asymmetrical knots are found in Qashqa'i weavings, whereas the Bakhtiari, Papi and Boyer Ahmad only use symmetrical knots. Since the only other group to use asymmetrical knots is also Turkic (the Yomut), it can be reasoned that the Turkic ancestors of the Qashqa'i probably used this type of knot, whereas the symmetrical knot was adopted from Persian-speaking groups. Modern Qashqa'i pile-knotting techniques thus represent the blending of two distinct traditions. However, the robust support (77%) for the clade comprising the Qashqa'i and neighbouring groups' assemblages returned by the bootstrap analysis of the technical traits data set suggests that such cases are rare. The more general trend of replacement of Turkic techniques by those long practised in the region might be explained by ecological factors, such as the availability of raw materials and the type of long-range pastoral adaptation characteristic of the Zagros mountain region. For example, some authors (Fielberg 1944; Andrews 1997) have noted that the black goat-hair tent is more portable than the framed felt tent favoured by the more sedentary Turkic nomads in northern and eastern Iran, and more suited to the climate in south-western Iran.

The origins of the patterns and motifs used to decorate Qashqa'i weavings, on the other hand, are firmly rooted in Turkic traditions. In the decorative traits cladogram, the Qashqa'i taxon clusters with the Turkic-speaking Shahsevan, Yomut and Tekke. Interestingly, the designs of the neighbouring Boyer Ahmad tribe, who speak Lor, also groups with these assemblages, and form a sub-clade with the Qashqa'i taxon. Thus, in a reversal of the technical traits pattern, the Boyer Ahmadi Lors' textile designs probably originate in the weavings of the Qashqa'i. The lack of a strong design tradition among the Persian-speaking tribes is demonstrated by the fact that these groups do not comprise a distinct lineage. Fieldwork observation of Bakhtiari weavers suggests that many of the patterns they employ are inspired by carpets made in urban workshops, rather than motifs passed down from previous generations. The high proportion of homoplastic traits in the decorative traits data set seem to be mostly concentrated in the Persian-speaking tribes' assemblages. This is demonstrated by the fact that the bootstrap support for the clade linking the Shahsevan, Yomut and Tekke assemblages and sub-clade comprising the Yomut and Tekke taxa are almost the same in both the decorative traits cladogram (52% and 95% respectively) and the technical traits cladogram (52% and 99%). In fact, there is a good reason to believe that for the Turkic groups, decorative traits are actually contain a stronger phylogenetic signal than the technical traits because the former links the Qashqa'i to the other Turkic tribal assemblages. When the Boyer Ahmad assemblage is removed from the data, a bootstrap analysis returns a strongly supported clade (85%) linking the four Turkic taxa. Moreover, the two sub-clades contained within it are also very well supported at 84% and 66% respectively. The first links the Turkmen-speaking Yomut and Tekke and the second links the Azeri-speaking Qashqa'i and Shahsevan, and is thus perfectly congruent with linguistic patterns.

These results are surprising given the relative ease with which decorative traits can be transmitted horizontally between groups. Unlike technical traits, textile patterns and motifs can be learned quickly, and do not require a costly investment of time or energy. Interviews with Bakhtiari tribeswomen confirmed that whereas new techniques are rarely acquired in adulthood, a weaver will learn many new designs over the course of her life. Anecdotal evidence suggests that designs can be copied with great ease: Beck (1991) reports that one Qashqa'i woman wove a carpet which based its designs on the embroidery of the anthropologist's handkerchief. These points raise the question of how the transmission of decorative traits might be constrained in such a way that they are inherited as part of a linked set, or core, as seems to be the case among the Turkic assemblages included in the sample. In discussing this issue, Shennan (2002) cites a study carried out by Ortman (2000) of textile and pottery designs in the Mesa Verde area of the American Southwest in the Great Pueblo era (11^{th} – 13^{th} centuries AD). Ortman shows that the designs featured on pottery vessels show the characteristics of very specific constraints arising from coiled basketry and loom-woven cloth making techniques, suggesting that they were copied from textiles. Moreover, there is evidence that although potters experimented with other types of design, these were rejected by other social learners and thus made little historical impact on the assemblages. According to Ortman, the enduring integrity of pottery and textile designs can be explained by an ideological constraint on adopting novel traits, based on a metaphorical association between containers and the cosmos in which the world is represented as an earth bowl and the sky as a basket.

Ortman's study suggests ways in which Turkic textile designs might be conceived of as a cultural core. Oriental textile scholars (e.g. Moshkova 1948; Opie 1991; Azadi 1975) have often assumed that tribal carpet designs are loaded with meanings relating to the history and identity of the tribe and their supernatural beliefs. For example, one rug scholar has recently claimed that "carpet makers in many tribal areas often faithfully repeat designs century after century, each daughter carefully maintaining the traditions imparted from her mother. As with many folkways, she undoubtedly feels that the work or the ritual is imbued with a certain power or magic which will be diluted or lost if significantly altered" (Train 1997:13). In anthropology, Tehrani and Collard (2001) have suggested that Turkmen carpet designs might constitute some sort of 'cultural recognition system' enabling individuals – particularly those seeking refuge from blood feuds – to identify camps that are likely to cooperate with them, making an analogy with mate recognition systems in biology. However, these views are not supported by ethnographic data collected in the field. Although weavers commonly employ nicknames for motifs and patterns such as 'chicken foot' or 'goat horns', they do not endow them with cosmological significance, nor do they make explicit associations between particular designs and tribal identity. Among the Qashqa'i, for example, I was commonly told that a design was unique to the tribe, even though I knew it to be copied from an urban carpet or from a Bakhtiari bag-face. I believe that misleading attributions of this sort were merely a means of satisfying my persistent questions regarding the designs they used, rather than a sincerely held belief about their origins. In fact, the questions probably made little sense to the weavers, who do not conceptualise their craft in the terms that rug merchants or Oriental textile specialists do in the west. In contrast to the latter, the weavers appeared to have a highly pragmatic approach to rug design, based on established patterns or commercial demand.

The lack of obvious barriers to horizontal transmission of decorative traits, or constraints on adopting novel traits, suggests that a more complex explanation than the 'cultural core' concept is required. In the light of the previous discussion, the core and periphery hypothesis is clearly problematic in the case of Iranian tribal textile assemblages. Although, overall, patterns in the technical traits data are more tree-like than in the decorative traits data, a more detailed examination of the results of the analyses suggests that the former do not comprise a single cultural core. In fact, the distributions of similar decorative traits among the Turkic groups are more consistent with a branching pattern of descent and comprise homologous craft lineages that are broadly compatible with the groups' linguistic relationships. This contrasts with the Persian-speaking groups, among whom decorative traits are more capriciously distributed but whose weaving techniques show evidence of long-term phylogenetic continuity. This is particularly evident in the case of the Lor-speaking Bakhtiari, Papi and Boyer Ahmad tribes, and is also suggested by the maintenance of a number of similarities between the Baluch and Talesh despite these groups being separated by more than 1,000km and 900 years. However, the contrasting histories of decorative and technical traditions among the assemblages indicates that, rather than consisting of a single core, Iranian tribal craft assemblages might consist of what Boyd et al. (1997) described as 'many coherent units' of descent. It seems that, while a number of traits are transmitted horizontally on an individual basis, there are 'multiple packages' of traits that are relatively long-lasting and resistant to change (Shennan 2002; Shennan & Collard – in press). This possibility is investigated further in the next two chapters.

CHAPTER 5

Multiple Packages? Processes of Descent, Assimilation and Independent Invention

5.1 Introduction

It has been argued that it is possible to reconstruct cultural phylogenies to the extent that "there are genealogical entities that have sufficient coherence, relative to the amount of mixing and independent evolution among entities, to create recognizable history" (Boyd et al. 1997:364). This claim seems justified as far as the current case study is concerned. Contrary to the predictions of the ethnogenesis hypothesis, cladistic methods have succeeded in recovering long-term patterns of inheritance for the Iranian tribal craft assemblages. At the same time, however, it is clear that the phylogenies yielded by analyses of the craft traits offer an incomplete account of the cultural histories of textile weaving among the populations included in the study. A significant number of resemblances conflict with the model of a hierarchical pattern of descent, suggesting that reticulation and/or independent evolution played a more important role than predicted by the phylogenesis model. The "genealogical entities" referred to in the quotation cannot therefore comprise whole assemblages, but probably consist of particular groups or sub-groups of traits that remain unaffected by other evolutionary processes. This possibility was investigated in relation to the idea that cultures are composed of 'cores' which remain coherent over long periods of time and evolve in a tree-like manner. However, as demonstrated in the previous chapter, the evidence for cultural cores in the Iranian tribal crafts assemblages is ambiguous. Separate analyses of technical and decorative craft traits suggested that, rather than being constituted by a single core, resemblances among the material culture assemblages comprise at least two homologous lineages, and possibly several other units of descent, assimilation and reticulation.

Therefore, in this chapter an alternative model will be investigated, which proposes that cultural assemblages are composed of 'many coherent units' (Boyd et al. 1997), or 'multiple packages' (Shennan 2002; Shennan & Collard – in press). Packages differ from cores in two senses: Firstly, a 'package' represents a smaller entity than a 'core', comprising a group of historically-connected traits rather than a broad-based, central tradition. Secondly, whereas core traits are inherited exclusively from ancestral populations, packages can be acquired from different sources, including ancestral populations and neighbouring societies (Boyd et al. 1997). Thus, unlike core traditions, packages embody multiple patterns of inheritance which cannot be described by a single phylogeny. On the other hand, individual packages maintain a greater degree of coherence over time than 'peripheral' trait groupings or genuinely ethnogenetic assemblages, in which traits are transmitted between groups on more of an individual basis. In more liberal conceptions, the line between the multiple packages hypothesis and the ethnogenesis hypothesis is somewhat blurred: some authors (e.g. Shennan & Collard – in press, p.5) have suggested that some packages may be so small as to be almost impossible to identify, consisting of elements of traditions (e.g. particular aspects of a ritual practise or subsitence activities). However, to avoid theoretical ambiguity and the methodological problems that would arise from it, the version of the multiple packages model investigated here is as distinctive from other hypotheses as possible, which requires that two predictions regarding the evolution of Iranian tribal craft assemblages should be fulfilled: This chapter will test the prediction that the populations from which the data were sampled acquired craft traits from multiple sources. In contrast to the the approach used in previous chapters, where relationships between the assemblages were defined in relation to a single pattern of inheritance, resemblances arising from descent and borrowings will be identified in relation to specific trait distributions. In the next chapter, correlations among the trait distributions will be examined to test the prediction that traits are acquired from different sources as 'packages', representing distinct and coherent craft traditions, rather than independent units of transmission and reticulation.

5.2 Methodology

So far, processes of cultural inheritance have been defined in relation to the most parsimonious tree obtained from analyses of the craft traits data. Thus, resemblances among the assemblages that were consistent with the tree (homologies) were assumed to have arisen by descent, whereas resemblances that conflicted with the tree (homoplasies) were assumed to result from other evolutionary processes. However, the utility of this dichotomy is compromised when patterns of descent for different cultural traditions are inconsistent with one another – as appears to be the case in the contradiction between the phylogenies obtained from the technical traits data and decorative traits data described in the previous chapter. Both these phylogenies, as well as that obtained from the original crafts traits data set, reflect the common ancestry of some populations (e.g. the Yomut and Tekke Turkmen) and assimilation among others (e.g. the Qashqa'i and Boyer Ahmadi Lor). In the former case, resemblances between assemblages were inherited from an ancestral population, whereas in the latter case, one population's craft traditions are effectively 'descended' from those of a neighbouring group. Consequently, the classification of resemblances as homologous is not necessarily informative about the (potentially different) processes that gave rise to them. The same point applies in relation to sources of homoplasy, principally because it is difficult to distinguish between reticulation and independent evolution using the kind of phylogenetic methods employed in previous chapters. In analyses of biological data sets, where the transmission of traits can be assumed to result from (vertical) inheritance, homoplastic resemblances usually represent independent evolution among a group of species (i.e. convergence). However, in cultural data sets, homoplasies can arise from two processes: independent evolution *or* cultural transmission. When investigating whether or not it is possible to recover a phylogeny for a group of cultural assemblages, or their core components, the distinction between both types of homoplasy was of less immediate importance than determining the overall proportion of homologous traits to homoplastic traits. However, in order to trace specific (and potentially multiple) patterns of inheritance, it is crucial to distinguish between resemblances arising from vertical transmission, horizontal transmission and other processes. This requires a more refined description of trait distributions than is permitted by a single phylogeny and the homology/homoplasy dichotomy used thus far.

Therefore, the approach taken here will examine specific distribution patterns for the resemblances shared among the assemblages in relation to linguistic affiliations and geographical proximity. Firstly, each individual trait was mapped onto a language tree and geographical figure, as shown in Figs. 15 & 16. In accordance with the principle of parsimony, hypotheses relating to cultural transmission were then evaluated in such a way that the number of instances of independent invention required to account for the distribution of each trait was minimised. Thus, vertical transmission was inferred when resemblances correlated with linguistic affiliations (used as a proxy for population histories), and horizontal transmission was assumed to occur mainly between neighbouring populations. Resemblances among groups who are neither linguistically related, nor geographically adjacent were interpreted as instances of independent invention. For example, character 94 'rosette version 2', is a carpet design shared by the Qashqa'i and Shahsevan (Fig. 14). These two populations are not adjacent to one another (Fig 16) so the resemblance between their rosette designs is unlikely to have arisen by horizontal transmission. Therefore, either the trait was invented by both populations independently, or was inherited from a common ancestral population. Since the language tree (Fig. 15) shows that both populations are descended from a Tukic, Azeri-speaking population, the principle of parsimony dictates that it is more likely that the version of the rosette design shared by the Qashqa'i and Shahsevan was inherited from a common ancestor and thus evolved once, rather than on two separate occassions.

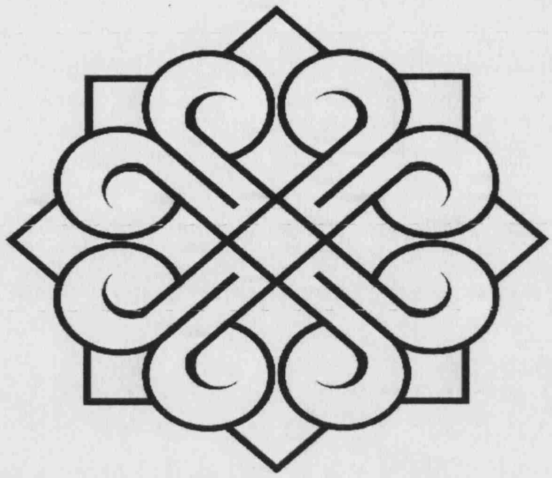


Fig 14: Character 94 "rosette version 2"

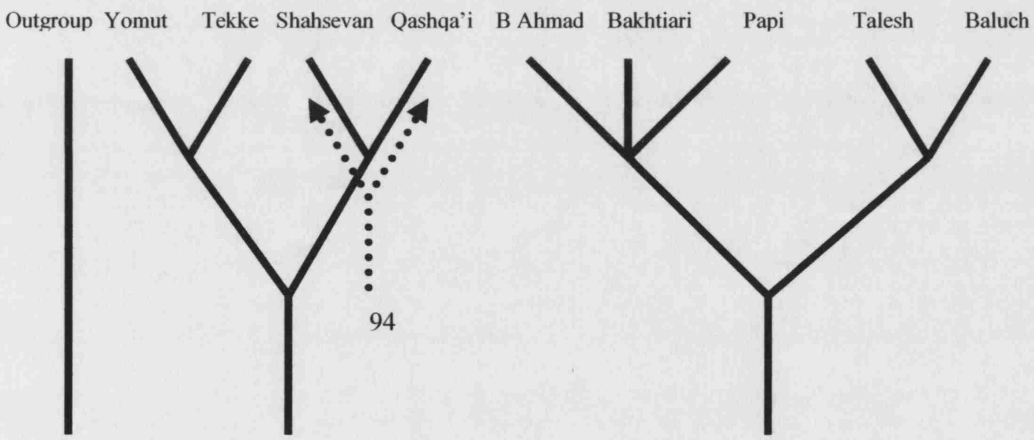


Fig 15: The linguistic distribution of Character 94, which is consistent with the vertical transmission hypothesis represented by the dotted arrow, according to which the Shahsevan and Qashqa'i acquired the trait from a common ancestral population.

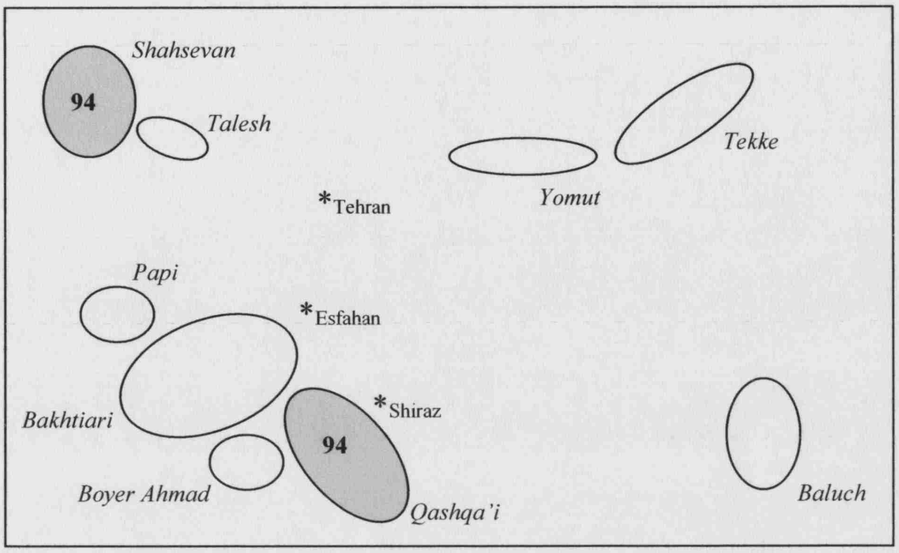


Fig 15: The geographical distribution of Character 94 (shaded). No hypothesis of horizontal transmission is represented due to the distance between the two groups, which makes it unlikely that the Qashqa'i and Shahsevan acquired the trait by borrowing processes .

It is possible that 'rosette version two' is derived from another character, '93: rosette version one', which the Qashqa'i and Shahsevan share with the two other Turkic groups, the Yomut and Tekke Turkmen (Fig 17). The latter can be classed as a 'primitive trait' inherited from the common ancestor of the Turkic groups, whereas the former can be classed as a 'derived trait', inherited from a more recent ancestor exclusively linking the Azeri-speaking Shahsevan and Qashqa'i. However, since character 93 is also with two non-Turkic populations, the Bakhtiari and Boyer Ahmadi Lor, the distribution of this rosette design cannot be entirely accounted for by descent. Therefore, either the trait arose twice – once in the Turkic lineage and once in a Lor lineage – or was transmitted horizontally. Based on the linguistic affliliations and geographical relationships of the groups which share character 93 (Figs. 18 & 19), the most likely explanation for the distribution of 'rosette version 1' involves a combination of vertical and horizontal transmission: specifically, the trait probably originated in the common ancestor of all the Turkic populations and was adopted by the (Lor-speaking) Bakhtiari and Boyer Ahmadi from the neighbouring (Turkic-speaking) Qashqa'i.

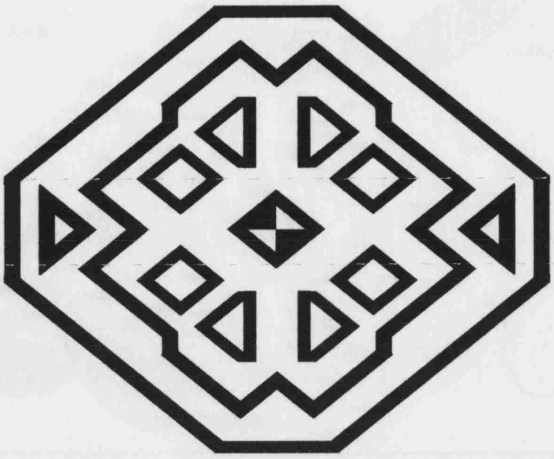


Fig 17: Character 93 'rosette version 1'

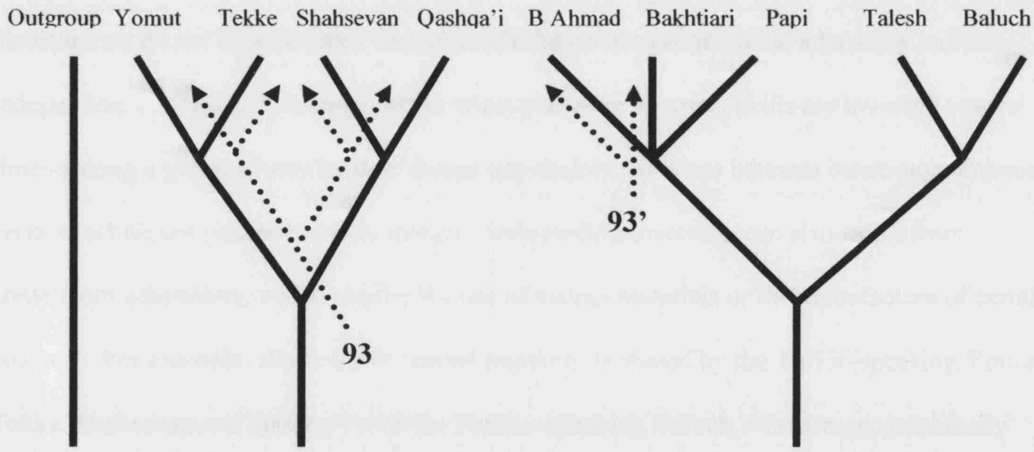


Fig 18: The linguisitic distribution of Trait 93. Hypotheses of vertical transmission are represented by a dotted arrow, according to which the trait arose twice (93 & 93').

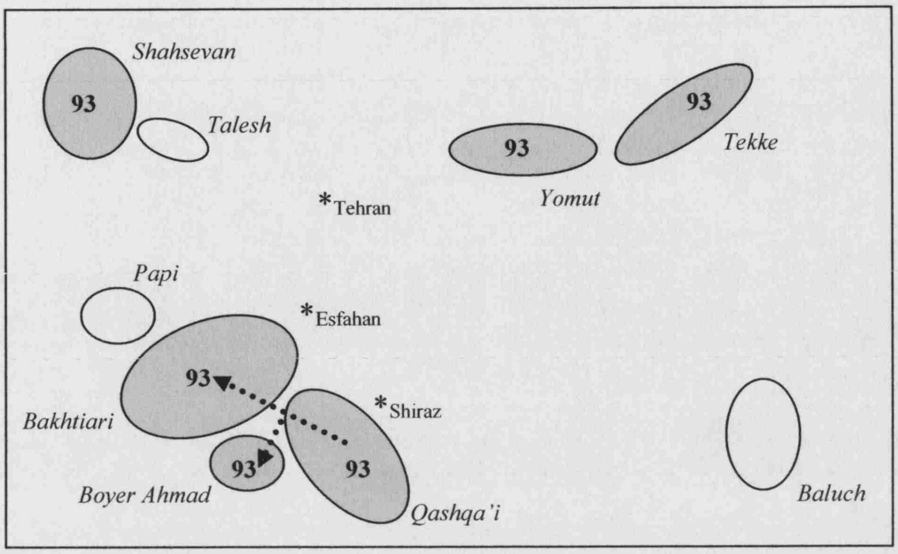


Fig 19: The geographical distribution of Trait 93 (shaded), showing horizontal transmission hypotheses (dotted arrow), according to which the Bakhtiari and Boyer Ahmad adopted the trait from the neighbouring Qashqa'i, rather than inventing it independently.

In other cases, however, neither vertical transmission, horizontal transmission, nor a combination of both can explain resemblances among the textile assemblages. Traits whose distributions do not fit with either linguistic affiliation nor geographical adjacency indicate independent evolution. This might occur when particular weaving skills are invented several times among a group of unrelated or distant populations, or when inherent constraints imposed by certain techniques generate similar designs. Independent invention can also result from convergent adaptations which require the use of certain materials or the manufacture of certain products. For example, character 44 'camel trapping' is shared by the Turkic-speaking Yomut, Tekke, Shahsevan and Qashqa'i with the Persian-speaking Baluch, who are geographically isolated from the other populations (Fig. 21). However, unlike other Persian-speaking groups, the Baluch use camels for transport in the desert territories they inhabit. The use of camels by Turkic-speaking groups probably has a longer history dating back to their Central Asian origins, where nomadic groups continue to use them in arid environments such as the Gobi Desert (Khazanov 1994). Therefore, the Baluch probably invented the techniques for manufacturing trappings for these animals independently, although given the changing configurations of tribal territories in the past, historical contact with Turkic-speaking populations cannot be excluded as a source. Nevertheless, it should be noted that Baluchi camel trappings are structurally more similar to flat-woven horse trappings, which are widely represented in the craft assemblages (both Turkic and Persian), than the pile trappings woven by the Turkmen, who are the nearest Turkic population to them, which suggests that borrowing was unlikely.

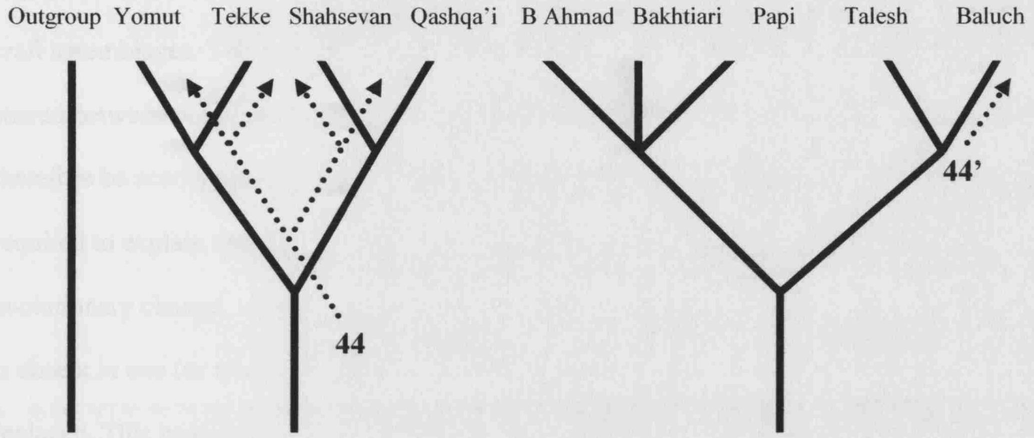


Fig 20 (above): The linguisitic distribution of Trait 44. Hypotheses of vertical transmission are represented by a dotted arrow, according to which the trait arose twice (44 & 44').

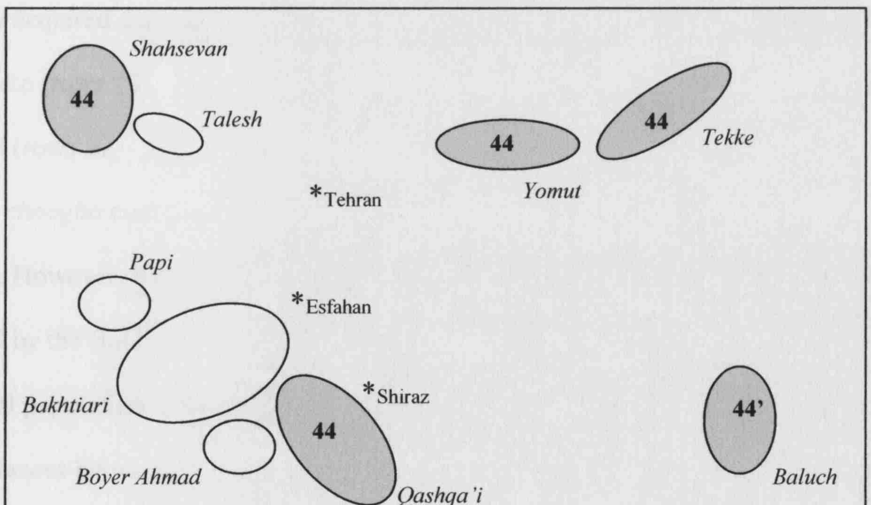


Fig 21 (above): The geographical distribution of Trait 44 (shaded). It is more likely that the Baluch invented the trait independently (44') rather than acquiring it from populations from which they are isolated.

5.3 Trait Distributions

Using this method, it was possible to determine the most likely cultural evolutionary processes which gave rise to resemblances between 86 craft traits, based on their linguistic and geographical distributions. These traits, and hypotheses relating to their origin and acquisition, are presented in Tables 2 - 4. The tables do not include autapomorphic traits which are exhibited by only one taxon ($n = 13$), nor universal traits shared by all the taxa ($n = 11$), since neither of these are informative about the specific processes which generated resemblances between the craft assemblages. Table 2 lists the 26 traits (c.30% of the total number of informative traits) shared between populations which are consistent with their linguisitic affliations, and could therefore be accounted for by descent from common ancestral populations. Additional hypotheses required to explain the distributions of these traits related to reversals in the sequence of evolutionary change, whereby a trait acquired by a group of populations from an ancestral entity is absent in one (or two) of the descendent populations, either because it was discarded or replaced. This process seems to have affected the evolution of 5 of the 6 traits identified as primitive to the Turkic group of populations (rows 1 – 6) and two of the three traits identified as primitive to the Persian group (rows 17 – 19). Reversals are less in evidence among the more recently acquired derived traits identified for the Shahsevan and Qashqa'i (rows 7 – 9), Yomut and Tekke (rows 10 – 16), Talesh and Baluch (rows 20 & 21) and Bakhtiari, Papi and Boyer Ahmadi (rows 22 – 26). In the latter group, it appears that animal-head tree designs (trait 103) and the *choogha* coat (trait 55) were inherited by the Papi and Bakhtiari, but not by the Boyer Ahmad. However, it is known that, as far as the latter trait is concerned, the *choogha* was in fact adopted by the Bakhtiari from the Papi, rather than having been inherited from a common ancestral population (Digard 2002). This example serves as a caution against assuming that resemblances between related populations necessarily arose through descent – it is possible that several of the traits listed here were transmitted between neighbouring populations who speak a similar language and share wider cultural affinities.

Table 2: Shared traits that are consistent with vertical transmission hypotheses, whereby resemblances between a group of assemblages were acquired by descent from common ancestral populations.

Colour-coding: *Based on the descent hypotheses, the rows are colour coded so that traits primitive to Turkic-speaking groups are shaded in orange, derived traits originating in a population ancestral to the Azeri-speaking Shahsevan and Qashqa'i are shaded in yellow and derived traits originating in a population ancestral to the Turkmeni-speaking Yomut and Tekke are shaded in red. Traits primitive to the Persian-speaking populations are shaded in turquoise, with derived traits originating in a common ancestor of the Lor-speaking Bakhtiari, Papi and Boyer Ahmad are shaded in green and derived Talesh/Baluch traits in blue.*

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
1	12: felt tent	Yom; Tekk; Shahsevan	**Primitive trait** inherited from Turkic-speaking ancestor.	**Reversal**: trait discarded or replaced by Qash
2	38: tent door cover	Yom; Tekk; Shahsevan	**Primitive trait** inherited from Turkic-speaking ancestor.	**Reversal**: trait discarded or replaced by Qash
3	109: octagonal *gul* design	Yom; Tekk; Shahsevan	**Primitive trait** inherited from Turkic-speaking ancestor.	**Reversal**: trait discarded or replaced by Qash
4	110: lobed *gul* design	Yom; Tekk; Shahsevan	**Primitive trait** inherited from Turkic-speaking ancestor.	**Reversal**: trait discarded or replaced by Qash
5	36: tablet-woven band with extra-weft wrapping	Tekk; Shahsevan; Qash	**Primitive trait** inherited from Turkic-speaking ancestor.	**Reversal**: trait discarded or replaced by Yomut
6	32: selvages using double-weft cording	Yom; Tekk; Shahs; Qash	**Primitive trait** inherited from Turkic-speaking ancestor.	None required
7	64: diamond with square-teeth edges	Shahsevan; Qash	**Derived trait** inherited from Azeri-speaking ancestor	None required
8	94: rosette version 2	Shahsevan; Qash	**Derived trait** inherited from Azeri-speaking ancestor	None required
9	106: 4-leg design ornament	Shahsevan; Qash	**Derived trait** inherited from Azeri-speaking ancestor	None required
10	39: pile-woven door cover	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required
11	47: pile-woven storage bag	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required
12	51: fur hat	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required
13	57: repeating *gul* carpet pattern	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required

14	72: reciprocal goat-horn border	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required
15	74: tipped goat-horn diamond	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required
16	83: curled s-leaf border	Yomut; Tekke	**Derived trait** inherited from Turkmen-speaking ancestor	None required
17	31: selvages using goat hair	Bakht; BA; Papi; Talesh; Baluch	**Primitive trait** inherited from Persian-speaking ancestor	None required
18	88: non-reciprocal wave motif	Bakht; Papi; Baluch	**Primitive trait** inherited from Persian-speaking ancestor?	**2 Reversals**: trait discarded/ replaced by BA and Talesh
19	98: teeth border	Bakht; Papi; Talesh	**Primitive trait** inherited from Persian-speaking ancestor?	**2 Reversals**: trait discarded/ replaced by BA and Baluch
20	15: loom heddle supported by tripod	Talesh; Baluch	**Derived trait** inherited from NW-Persian speaking ancestor	None required
21	105: *no memling* ornament	Talesh; Baluch	**Derived trait** inherited from NW-Persian speaking ancestor	None required
22	30: selvages using overcast threads	Bakht; Papi; BA	**Derived trait** inherited from Lor-speaking ancestor	None required
23	49: shooting camoflauge	Bakht; Papi; BA	**Derived trait** inherited from Lor-speaking ancestor	None required
24	108: "infinity" motif	Bakht; Papi; BA	**Derived trait** inherited from Lor-speaking ancestor	None required
25	55: plain-woven woolen cloak (*choogha*)	Bakht; Papi	**Derived trait** inherited from Lor-speaking ancestor	**Reversal:** trait discarded/ replaced by BA Lors
26	103: animal-head trees	Bakht; Papi	**Derived trait** inherited from Lor-speaking ancestor	**Reversal:** trait discarded/ replaced by BA Lors

Although it is difficult to establish the extent to which related populations exchange cultural traits with one another through horizontal transmission processes, it is reasonable to assume that similarities between unrelated groups which are geographically adjacent to one another probably arose in this way. Table 3 lists 37 craft traits shared among Iranian tribal populations which cannot be entirely accounted for by inheritance from ancestral populations. Additional hypotheses required to explain the distributions of these traits include reversals (affecting a total of eight traits) and processes of horizontal transmission inferred from resemblances between geographically proximate populations which are not linguistically related to one another. The total number of traits listed in Table 3 represents 43% of all informative traits ($n = 86$), a significantly higher figure than the percentage of traits whose distributions can be explained by vertical transmission (with reversals) alone (30%). Since the latter probably includes traits which were borrowed from linguistically-related neighbouring populations (as indicated by the example of the *choogha* coat made by Papi Lors and the Bakhtiari) it can be concluded that many Iranian tribal craft traditions were strongly influenced by cultural exchanges between contemporaneous populations. A large proportion of the traits identified as primitive to the Turkic-speaking and Persian-speaking populations respectively have been adopted by unrelated groups: a total of 14 traits which probably originated in a Turkic-speaking ancestor of the Yomut, Tekke, Shahsevan and Qashqa'i (rows 1 – 14) have been acquired by Persian-speaking groups, primarily the Boyer Ahmadi Lors and Bakhtiari who neighbour the Qashqa'i – more than double the number of primitive Turkic traits whose distribution can be explained by descent alone (rows 1 – 6, Table 2). Similarly, five technical traits which were probably inherited from a population ancestral to the Boyer Ahmadi Lors, Bakhtiari, Papi, Baluch and Talesh (rows 24 – 28) have been acquired by the Turkic-speaking Qashqa'i from their Lor-speaking neighbours, two of which (trait 6: corded wool & trait 46: flat-woven saddle-bag) appear to have been adopted by the Shahsevan from the Talesh. By comparison, only three primitive traits are exclusive to Persian-speaking groups (rows 17 – 19 Table 1). Derived traits associated with the Azeri-speaking Shahsevan and Qashqa'i and Lor-speaking Papi, Boyer Ahmadi and Bakhtiari (rows 15 – 23 and 29 – 37 respectively) have also been exchanged in greater numbers than those whose distributions can be entirely accounted for by linguisitic affiliations (rows 7 – 9 and 22 – 26 Table 2). However, derived traits associated with the two Turkmen populations, the Tekke and Yomut, and the linguistically-related Talesh and Baluch are not represented in the table. With the exception of the Talesh, this can be accounted for by the relative isolation of these populations from unrelated groups.

Table 3: Shared traits that can be accounted for by a combination of hypotheses of vertical and horizontal transmission, whereby resemblances between assemblages can be accounted for by descent from ancestral assemblages as well as transmission between unrelated neighbouring groups.

Colour-coding: as in Table 2

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
1	17: pile carpet	Yom; Tekk; Qash; Bakht; BA; Papi	**Primitive trait** acquired by Yom; Tekk & Qash from Turkic-speaking ancestor	**Reversal**: trait discarded/ replaced by Shahsevan **Horizontal trans:** Qash ➔ Bakht; BA; Papi
2	22: 2 weft-shots	Yom; Tekk; Qash; Bakht; BA; Papi	**Primitive trait** acquired by Yom; Tekk & Qash from Turkic-speaking ancestor	**Reversal**: trait discarded/ replaced by Shahsevan **Horizontal trans:** Qash ➔ Bakht; BA; Papi
3	53: felt cloak	Yom; Tekk; Shah; Qash; Bakht; BA; Papi	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-4speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi
4	76: 8-point star	Yom; Tekk; Shah; Qash; Bakht; BA; Papi; Talesh	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi **Horizontal trans:** Shah ➔ Talesh
5	13: felt carpet	Yom; Tekk; Shah; Qash; Bakht; BA; Papi; Talesh	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi **Horizontal trans:** Shah ➔ Talesh
6	77: 8-point star version 1	Yom; Tekk; Shah; Qash; Bakht; BA; Papi	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi
7	45: pile-woven saddle-bag	Yom; Tekk; Qash; Bakht	**Primitive trait** acquired by Yom; Tekk & Qash from Turkic-speaking ancestor	**Reversal**: trait discarded/ replaced by Shahsevan **Horizontal trans:** Qash ➔ Bakht
8	58: garden carpet design	Yom; Tekk; Qash; Bakht	**Primitive trait** acquired by Yom; Tekk & Qash from Turkic-speaking ancestor	**Reversal**: trait discarded/ replaced by Shahsevan **Horizontal trans:** Qash ➔ Bakht
9	75: arrow-cross ornament	Yom; Tekk; Qash; Bakht; BA	**Primitive trait** acquired by Yom; Tekk & Qash from Turkic-speaking ancestor	**Reversal**: trait discarded/ replaced by Shahsevan **Horizontal trans:** Qash ➔ Bakht; BA

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
10	92: rosette motifs	Yom; Tekk; Shah; Qash; Bakht; BA	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA
11	93: rosette version 1	Yom; Tekk; Shah; Qash; Bakht; BA	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA
12	101: animal head border	Yom; Shah; Qash; Bakht; BA	**Primitive trait** acquired by Yom; Shah & Qash from Turkic-speaking ancestor	**Reversal:** Trait discarded/ replaced by Tekke **Horizontal trans:** Qash ➔ Bakht; BA
13	81: simple s-border	Yom; Tekk; Shah; Qash; BA	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ BA
14	96: straight comb motif	Yom; Tekk; Shah; Qash; BA	**Primitive trait** acquired by Yom; Shah; Tekk & Qash from Turkic-speaking ancestor	**Horizontal trans:** Qash ➔ BA
15	16: vertical loom	Shah; Qash; Papi; Bakht	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; Papi
16	25: slit-tapestry technique	Shah; Qash; BA	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ BA
17	89: reciprocal bulb border	Shah; Qash; BA	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ BA
18	28: *sumak* weft-wrapping technique	Shah; Qash; Bakht; BA; Papi	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi
19	43: flat-woven horse trapping	Shah; Qash; Bakht; BA; Papi	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi
20	50: felt cap	Shah; Qash; Bakht; BA; Papi	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi
21	60: row patterns	Shah; Qash; BA; Papi; Talesh	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ BA; Papi **Horizontal trans:** Shah ➔ Talesh
22	29: warp-faced flat-weaving	Shah; Qash; Bakht; BA; Papi; Talesh	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi **Horizontal trans:** Shah ➔ Talesh
23	78: 8-point star version 2	Shah; Qash; BA; Talesh	**Derived trait** inherited by Shah & Qash from Azeri-speaking ancestor	**Horizontal trans:** Qash ➔ BA **Horizontal trans:** Shah ➔ Talesh

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
24	2: woven goat-hair	Qash; Bakht; BA; Papi; Talesh; Baluch	**Primitive trait** inherited by Bakht; BA; Papi; Talesh & Baluch from Persian-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
25	42: basketry	Qash; Bakht; BA; Papi; Talesh; Baluch	**Primitive trait** inherited by Bakht; BA; Papi; Talesh & Baluch from Persian-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
26	5: spun cotton	Qash; Bakht; BA; Talesh	**Primitive trait** inherited by Bakht; BA & Talesh from Persian-speaking ancestor	**2 Reversals:** trait discarded/ replaced by Papi & Baluch **Horizontal trans:** Bakht/BA → Qash
27	6: corded wool	Shah; Qash; Bakht; BA; Papi; Talesh; Baluch	**Primitive trait** inherited by Bakht; BA; Papi; Talesh & Baluch from Persian-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash **Horizontal trans:** Talesh → Shahsevan
28	46: flat-woven saddle bag	Shah; Qash; Bakht; BA; Papi; Talesh; Baluch	**Primitive trait** inherited by Bakht; BA; Papi; Talesh & Baluch from Persian-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash **Horizontal trans:** Talesh → Shahsevan
29	18: rough pile carpet (*gabbeh*)	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
30	37: tassled tent surround	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
31	52: women's head band	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
32	59: medallion carpet patterns	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
33	67: diamond medallion patterns	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
34	82: bird s-borders	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
35	90: reciprocal c-border	Qash; Bakht; BA; Papi	**Derived trait** inherited by Bakht; BA & Papi from Lor-speaking ancestor	**Horizontal trans:** Bakht/BA → Qash
36	104: arrow-shaped animal head trees	Qash; BA; Papi	**Derived trait** inherited by BA & Papi from Lor-speaking ancestor	**Reversal:** trait discarded/ replaced by Bakht. **Horizontal trans:** BA → Qash
37	107: *boteh* motif	Qash; Bakht; BA	**Derived trait** inherited by Bakht & BA from Lor-speaking ancestor	**Reversal:** trait discarded/ replaced by Papi. **Horizontal trans:** Bakht/BA → Qash

The final table (Table 4) lists 23 traits whose distributions cannot be fully explained by linguistic affiliations and/or by geographical proximity, representing 27% of the total number of informative traits. Resemblances between these traits therefore require further additional hypotheses to descent, reversals and horizontal transmission: independent invention. The distributions of 9 of the traits listed in Table 4 can be accounted for by vertical transmission and instances of independent invention, while the distributions of a further 6 traits also require hypotheses of horizontal transmission. Three other traits (rows 17 – 19) might have been acquired through either descent (with more than one reversal) or independent invention – both explanations require the same number of hypotheses and are thus equally parsimonious. The distributions of the remaining four traits (rows 20 – 23) are not compatible with any hypotheses of vertical transmission and appear to have been acquired through a combination of horizontal transmission and independent invention, or in the case of traits 27 'extra-weft pile-wrapping' and 86 'double-crested wave motif' (rows 22 & 23), by independent invention alone. The latter trait, which is present in the Tekke and Baluch assemblages, probably originated as a variation on the reciprocal wave motif which the Persian-speaking Baluch also share with distant Turkic-speaking populations, as well as with the Boyer Ahmadi Lors who probably acquired it from the Qashqa'i. Repetitive, geometric designs such as these are typical of flat-woven textiles, the technical constraints of which often produces similar patterns. This is illustrated by the many similarities among the designs used on Iranian flat-weave carpets and those produced by similar techniques in California and Mexico (Stone 1997). A particularly common pattern is the 'all-over diamond', a repetitive, geometric diamond motif recorded as character 68, which is shared by the Qashqa'i, Boyer Ahmadi Lor and Talesh. Given the relative ease with which this design can be woven using flat-weave techniques, it is certainly conceivable that this trait was invented by each of the four groups. However, according to the logic employed here, it can be reasoned that the all-over diamond was transmitted directly between the Qashqa'i and Boyer Ahmadi Lor who are geographically adjacent to one another, possibly as part of a 'package' of inter-related flat-weaving traits. The Talesh, who are geographically distant from these groups, must therefore have invented the design independently. Four other designs which typify flat-woven textiles are included in the table: 66 'cross-diamond motifs' (row 6), 95 'serrated comb motif' (row 7), 99 'animal-shaped motifs' (row 10) and 69 'inter-locking diamond border' (15). Other resemblances between designs used on pile-woven and other texiles (rows 3 – 6, 9, 14 & 17) appear to have also arisen through independent invention, but these are always limited to extremely simple motifs, rather than complex ornaments. The remaining resemblances produced by independent invention relate to the exploitation of similar environments (rows 2, 11 & 12 – see the discussion of trait 44 above); and through innovations in weaving techniques which were probably discovered independently (rows 1, 12, 16, 18, 19, 21 & 22).

Table 4: Shared traits that cannot be entirely accounted for by hypotheses of vertical and/or horizontal transmission. Resemblances between assemblages therefore require additional hypotheses of independent invention.

Colour-coding: as in Tables 2 & 3

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
1	34: end-finishes using weft-float brocading	Yom; Tekk; Shah; Qash; Baluch	**Primitive trait** inherited by Yomut; Tekke; Shah & Qash from Turkic ancestor	**Independent invention**: Baluch
2	44: camel trapping	Yom; Tekk; Shah; Qash; Baluch	**Primitive trait** inherited by Yomut; Tekke; Shah & Qash from Turkic ancestor	**Independent invention**: Baluch
3	70: goat-horn motifs	Yom; Tekk; Shah; Qash; Baluch	**Primitive trait** inherited by Yomut; Tekke; Shah & Qash from Turkic ancestor	**Independent invention**: Baluch
4	73: goat-horn crosses	Yom; Tekk; Shah; Qash; Baluch	**Primitive trait** inherited by Yomut; Tekke; Shah & Qash from Turkicancestor	**Independent invention**: Baluch
5	71: goat-horn border	Yom; Tekk; Shah; Baluch	**Primitive trait** inherited by Yomut; Tekke & Shah from Turkic ancestor	**Reversal:** trait discarded/ replaced by Qash **Independent invention**: Baluch

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
6	66: cross-diamond motifs	Yom; Tekk; Qash; BA; Baluch	**Primitive trait** inherited by Yom, Tekke & Qash from Turkic ancestor	**Reversal:** trait discarded/ replaced by Shah **Horizontal trans:** Qash ➔ BA **Independent invention**: Baluch
7	95: serrated comb motif	Yom; Tekk; Qash; BA; Baluch	**Primitive trait** inherited by Yom, Tekke & Qash from Turkic ancestor	**Reversal:** trait discarded/ replaced by Shah **Horizontal trans:** Qash ➔ BA **Independent invention**: Baluch
8	87: reciprocal wave motif	Yom; Shah; Qash; BA; Baluch	**Primitive trait** inherited by Yom, Shah & Qash from Turkic ancestor	**Reversal:** trait discarded/ replaced by Tekke **Horizontal trans:** Qash ➔ BA **Independent invention**: Baluch
9	91: tulip designs	Yom; Tekk; Qash; Bakht; BA; Baluch	**Primitive trait** inherited by Yomut; Tekke & Qash from Turkic ancestor	**Reversal:** trait discarded/ replaced by Shah **Horizontal trans:** Qash ➔ Bakht; BA **Independent invention**: Baluch
10	99: animal-shaped motifs	Yom; Tekk; Shah; Qash; Bakht; BA; Papi; Baluch	**Primitive trait** inherited by Yomut; Tekke; Shah & Qash from Turkic ancestor	**Horizontal trans:** Qash ➔ Bakht; BA; Papi **Independent invention**: Baluch
11	41: pile-woven salt bag	Yom; Tekke; Papi	**Derived trait** inherited by Yomut and Tekke from Turkmen-speaking ancestor	**Independent invention:** Papi
12	7: plaited wool	Shahsevan; Qash; Papi	**Derived trait** inherited by Shahsevan & Qash from Azeri-speaking ancestor	**Independent invention:** Papi? Possibly adopted from Qash **Independent invention:** Baluch
13	10: straw mat	Qash; Talesh; Baluch	**Derived trait** inherited by Talesh & Baluch from NW-Persian speaking ancestor	**Independent invention:** Qashqa'i
14	65: diamond with antennae extensions	Tekke; Bakht; Talesh; Baluch	**Derived trait** inherited by Talesh & Baluch from NW-Persian speaking ancestor	**Independent invention:** Bakhtiari **Independent invention:** Tekke

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
15	69: inter-locking diamond border	Bakht; Talesh; Baluch	**Derived trait** inherited by Talesh & Baluch from NW-Persian speaking ancestor	**Independent invention:** Bakhtiari
16	20: symmetrical pile-knots	Yomut; Qashqa'i; Bakht; BA; Papi	**Derived trait** inherited by Bakht, BA & Papi from Lor-speaking ancestor	**Horizontal transmission:** Bakht/BA ➔ Qash **Independent invention:** Yomut
17	97: angled comb motifs	Yomut; Qashqa'i	**Primitive trait** inherited by Tekke & Qash from Turkic ancestor?	**Reversals:** trait discarded/ replaced by Tekke & Shahsevan (=2 hypotheses of evolutionary change) **OR** **Independent invention:** Trait acquired independently by Yomut & Qash? (= 2 hypotheses of evolutionary change)
18	19: asymmetrical pile knots	Tekke; Qash	**Primitive trait** inherited by Tekke & Qash from Turkic ancestor?	**Reversals:** trait discarded/ replaced by Yom & Shahsevan (=2 hypotheses of evolutionary change) **OR** **Independent invention:** Trait acquired independently by Tekke & Qash? (= 2 hypotheses of evolutionary change)
19	21: warp depressed	Tekke; Qash	**Primitive trait** inherited by Tekke & Qash from Turkic ancestor?	**Reversals:** trait discarded/ replaced by Yom & Shahsevan (=2 hypotheses of evolutionary change) **OR** **Independent invention:** Trait acquired independently by Tekke & Qash? (= 2 hypotheses of evolutionary change)

	Trait	Distribution	Hypothesis of Descent	Additional Hypotheses
20	68: "all-over" diamond pattern	Qash; BA; Talesh	None	**Horizontal transmission:** Qash ←→ BA **Independent invention:**Talesh
21	24: shared-warp weaving technique	Qash; BA; Baluch	None	**Horizontal transmission:** Qash ←→ BA **Independent invention:**Baluch
22	27: extra-weft pile-wrapping	Tekke; Bakht	None	**Independent invention:** Trait acquired independently by Tekke & Bakht
23	86: double-crested wave motif	Tekke; Baluch	None	**Independent invention:** Trait acquired independently by Tekke & Baluch

5.4 Patterns of Cultural Inheritance

The results of the analyses of the linguistic and geographical distributions of Iranian tribal craft traits suggests that resemblances between the assemblages were derived from several sources: only a minority (30%) of resemblances could be explained by descent from ancestral populations alone, with more than two-thirds (70%) of the trait distributions requiring additional hypotheses of horizontal transmission and/or independent invention. This suggests that, in general, the evolution of Iranian tribal craft assemblages fits the model of multiple patterns of inheritance, which proposes that cultural assemblages are comprised of a number of traditions acquired from different sources (Boyd et al. 1997; Shennan 2002; Shennan & Collard – in press). The remainder of this chapter will address this hypothesis in relation to the the relative contributions of the different cultural evolutionary processes identified and described in Tables 2-4 in generating each individual assemblage.

As would be expected from the results of the phylogenetic analyses, trait distributions resulting from processes of cultural transmission consistently supported a single common origin for the Yomut and Tekke taxa. These two assemblages are linked by eight derived traits which were probably inherited from an ancestral population, one of which (41: 'pile-woven salt bag') is shared with the Papi Lors, from whom they are geographically isolated and linguistically unrelated, suggesting that this resemblance arose through independent invention. The Yomut and Tekke also appear to have inherited 28 other traits which probably originated in a Turkic-speaking ancestor which they share with the Shahsevan and Qashqa'i. Although the majority of these traits are also shared with Persian-speaking populations, this can be accounted for either by independent invention, or as a result of horizontal transmission between other Turkic-speaking groups and their neighbours. The inheritance of Yomut and Tekke craft traditions from ancestral populations (Fig. 22) supports the theory put forward by Tehrani and Collard (2002) that Turkmen craft assemblages evolved through simple phylogenetic processes (i.e. the progressive subdivision of ancestral taxa into new ones). In contrast, the model of multiple patterns of inheritance presupposes a certain amount of contact and cultural exchange between neighbouring populations, which does not appear to have had any impact on the evolution of the Tekke and Yomut assemblages. This can be accounted for by the relative isolation of the Tekke and Yomut from other, unrelated populations - although horizontal transmission between the two groups themselves cannot be discounted (Fig. 23).

*Fig 22: Vertical transmission processes in the evolution of the Tekke and Yomut craft assemblages (black dotted arrows). Inheritance from two ancestral populations (a & b) is hypothesised.The Yomut and Tekke share primitive traits with the Shahsevan and Qashqa'i, who are also descended from population **a** (grey dotted arrow). The Yomut and Tekke have also inherited traits from an exclusive common ancestor of more recent origin, population **b**.*

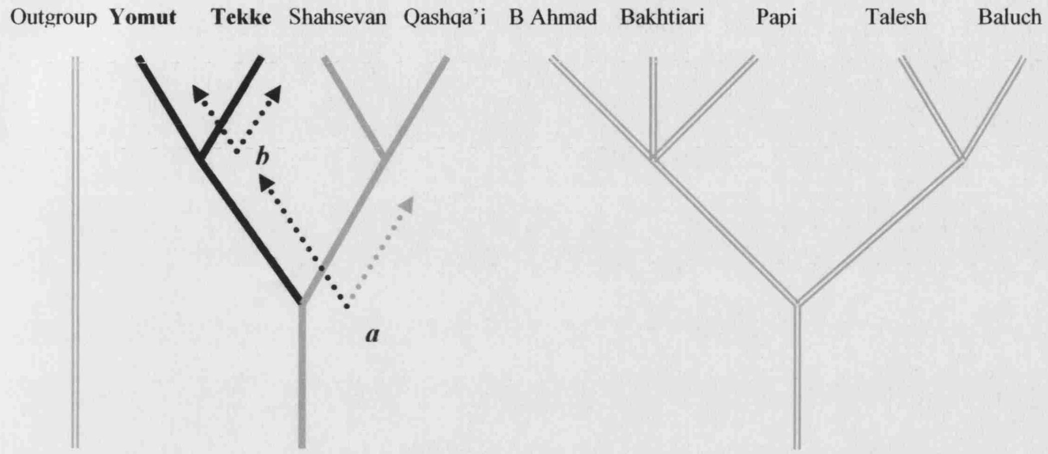
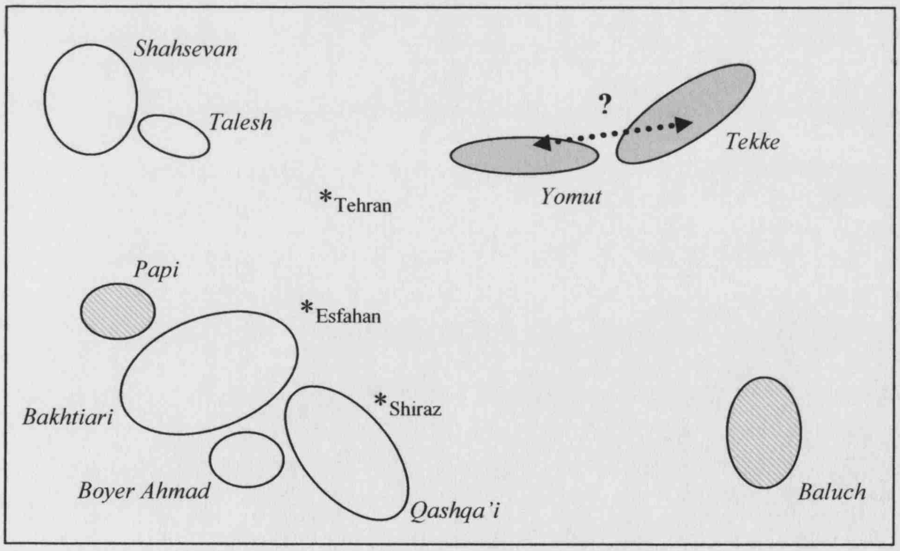


Fig 23: The possibility of horizontal transmission (dotted arrow) between the Yomut and Tekke cannot be excluded - nor confirmed. Resemblances with other groups resulting from independent invention are represented by partially-shaded taxa.



Likewise, the craft traditions of the Baluch appear to have developed largely in isolation from the other populations included in the study, from whom they are geographically separated. The majority of resemblances between the Baluch and other assemblages can be accounted for by independent invention (11 traits in total), although some traits shared with other Persian-speaking groups were probably inherited from an ancestral population. Five traits identified as primitive to Persian-speaking groups are present in the Baluchi assemblage, while a further five traits appear to have been acquired from a more recent ancestral group from which the Talesh are also descended. It is possible that some of the resemblances shared with Turkic-speaking groups might have been acquired through horizontal transmission processes, although this cannot be confirmed using the present data: although some Baluchi populations in the north-east of Iran are close to Turkmen populations in Khorasan, Baluchi textiles included in this sample originated from the south-eastern frontier with Pakistan – some 800 km from the Tekke. Moreover, if the Baluch borrowed craft traits from a Turkmen source, we might expect them to have also adopted some traits specifically associated with the latter. However, of the 10 traits shared by the Baluch with either the Tekke or Yomut, not a single derived trait associated with these populations is represented. In the absence of any firm evidence on which to base hypotheses of horizontal transmission, the results of the investigation carried out here suggests that the evolution of the Baluchi assemblage does not conform to the multiple patterns of inheritance model.

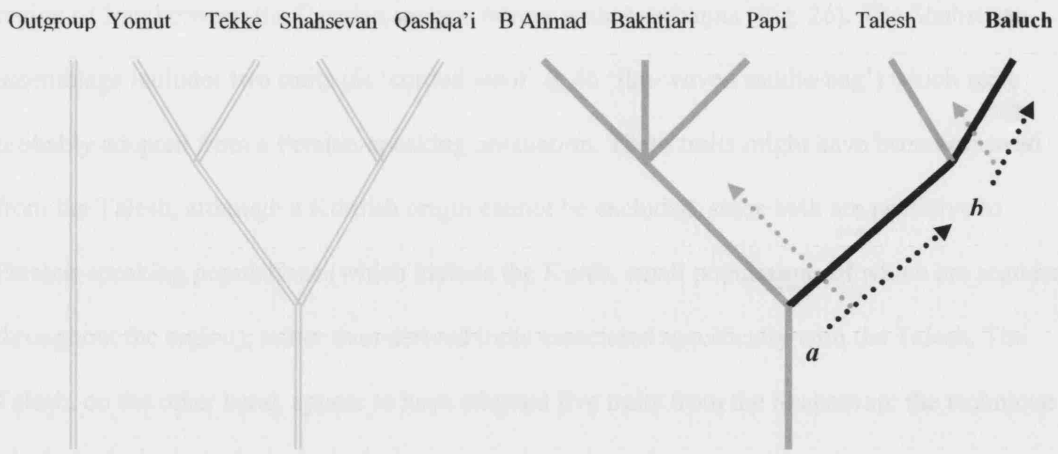


*Fig 24: The descent of Baluchi craft traditions(black dotted arrow) from two hypothetical ancestral groups (**a** & **b**). The Baluch share primitive traits with other Persian-speaking groups descended from population **a** (grey dotted arrow) and derived traits with the Talesh (grey dotted arrow), to whom they are more closely related linguistically and share a common ancestor of more recent origin, population **b**.*

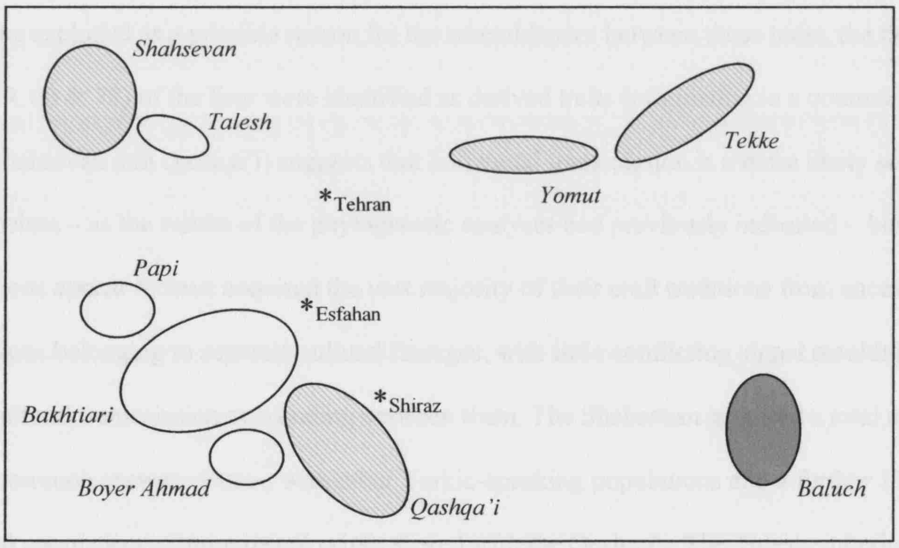


Fig 25: Resemblances between the Baluch and unrelated populations (partially shaded) probably resulted from independent invention, rather than horizontal transmission.

The effects of horizontal transmission are more likely to be detected among the remaining six populations, who are all adjacent to linguistically unrelated populations. However, there is little evidence of multiple patterns of inheritance among the Talesh, who speak a Persian language, and the Turkic Azeri-speaking Shahsevan, both of whom inhabit the north western region of Iran between the Caspian sea and border with Azerbaijan (Fig. 26). The Shahsevan assemblage includes two traits (6: 'corded wool' & 46 'flat-woven saddle-bag') which were probably adopted from a Persian-speaking population. These traits might have been borrowed from the Talesh, although a Kurdish origin cannot be excluded, since both are primitive to Persian-speaking populations (which include the Kurds, small populations of which are scattered throughout the region), rather than derived traits associated specifically with the Talesh. The Talesh, on the other hand, appear to have adopted five traits from the Shahsevan: the technique of warp-faced flat-weaving (trait 29), making felt carpets (trait 13) and three design traits – row patterns (trait 60), eight-point stars (trait 76), and a particular version of the latter (trait 78). With the exception of felt carpets, all these traits relate to flat-woven textiles, the tradition of which is especially developed among the Shahsevan (Tanavoli 1985). Although independent invention cannot be excluded as a possible reason for the resemblances between these traits, the fact that three (29, 60 & 78) of the four were identified as derived traits (originating in a common ancestor of the Shahsevan and Qashqa'i) suggests that horizontal transmission is a more likely source. Nevertheless – as the results of the phylogenetic analyses had previously indicated - both populations appear to have acquired the vast majority of their craft traditions from ancestral populations belonging to separate cultural lineages, with little conflicting signal resulting from direct cultural transmission or blending between them. The Shahsevan acquired a total of 22 traits from a common ancestor shared with other Turkic-speaking populations and a further 13 from an ancestral population of more recent origin shared with the Qashqa'i. The Talesh, inherited six traits primitive to Persian-speaking groups and five traits shared with the Baluch, to whom they are more closely related linguistically (Fig. 27).

Fig 26:. Horizontal transmission (dotted arrows) between the Shahsevan and Talesh. The relative width of the dotted arrows reflects the greater influence of Shahsevan craft traditions on those of the Talesh than vice versa.

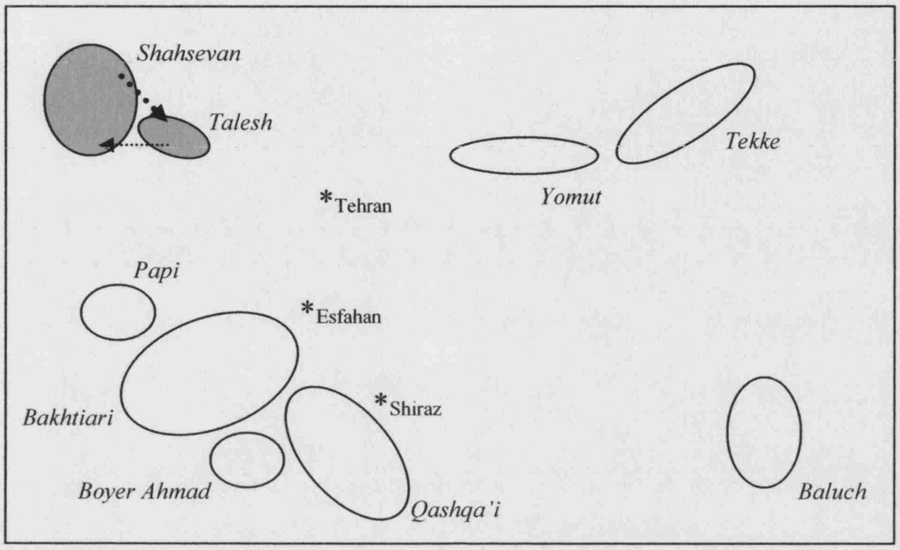
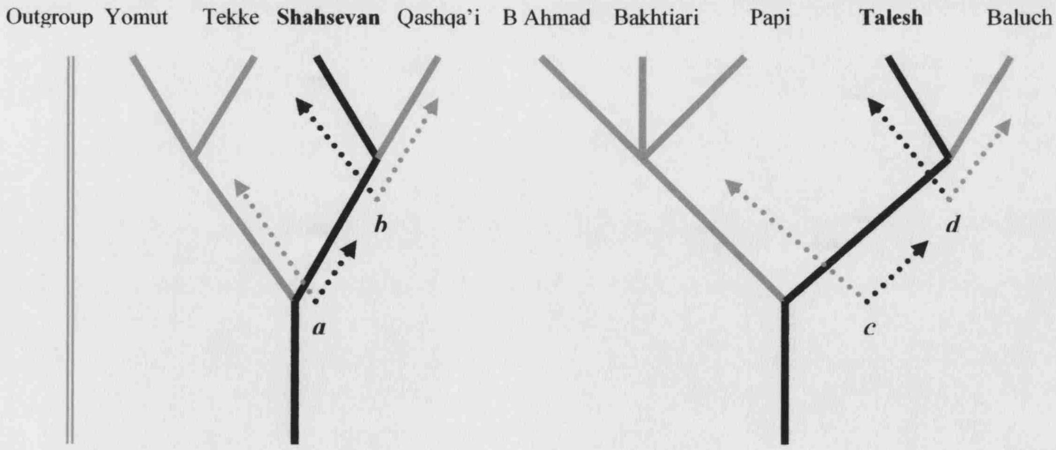


*Fig 27:. Processes of vertical transmission (black dotted arrows) through which the Shahsevan and Talesh inherited traits from separate ancestral populations (**a &b; c & d**). Each shares traits with related populations who inherited craft traditions from common ancestral populations (grey dotted arrows).*



Patterns of inheritance for the remaining four assemblages are, however, are far more complex. Relatively few of the craft traditions comprising the Qashqa'i, Boyer Ahmadi Lor, Papi Lor and Bakhtiari assemblages evolved exclusively by descent from common ancestral populations. Fifteen of the traits shared among them probably originated in an assemblage produced by the common ancestor of the Lor-speaking Bakhtiari, Boyer Ahmadi Lor and Papi Lor (Fig. 28). However, only five of these traits are shared exclusively by the descendents of this putative ancestral population. The remaining ten traits, as well as five of the eight traits primitive to all the Persian-speaking populations, have all been adopted by the neighbouring Turkic-speaking Qashqa'i. It has been suggested that many of the similarities between the assemblages associated with the Qashqa'i and Lor-speaking populations might have resulted from the mixed ancestry of the former, since ethnohistorical evidence indicates that the growth of the Qashqa'i confederacy partly involved the absorption of Lor-speaking groups (Beck 1986). Whilst this explanation might be partially correct, it cannot account for the large number of traits shared by the Qashqa'i and their neighbours which are probably Turkic in origin, since the ethnohistorical record does not suggest that Lor-speaking tribes assimilated Turkic groups to the same extent. Traits probably inherited by the Qashqa'i from an ancestral Turkic population include 25 primitive traits and thirteen derived traits shared with the Shahsevan, who also speak a dialect of Azeri (Fig. 28). All but seven of the former group, and three of the latter have been transmitted to non-Turkic groups neighbouring the Qashqa'i. These traditions appear to have made particularly important contributions to the Boyer Ahmadi and Bakhtiari assemblages. A total of 25 traits and 19 traits of Turkic origin were borrowed by these groups respectively. Some of these (twelve traits in total) are also present in the Papi assemblage, which although not geographically adjacent to the Qashqa'i, were probably acquired from their closest neighbours, the Bakhtiari. Examples such as these appear to constitute part of a broader pattern of reciprocal cultural exchanges between populations in the Zagros mountain range (Fig. 29). If the mixed ancestry of the

Qashqa'i facilitated their inclusion in this 'community of culture', their participation in it certainly contributed to the uniquely heterogenous character of craft assemblages in the region.

*Fig 28: Processes of vertical transmission (black dotted arrows) through which the Boyer Ahmad, Papi and Bakhtiari and the Qashqa'i inherited traits from ancestral populations (**a** & **b**; **c** & **d**). As in previous diagrams, the grey dotted arrows represent the inheritance of craft traits by groups related to the focal groups from common ancestral populations.*

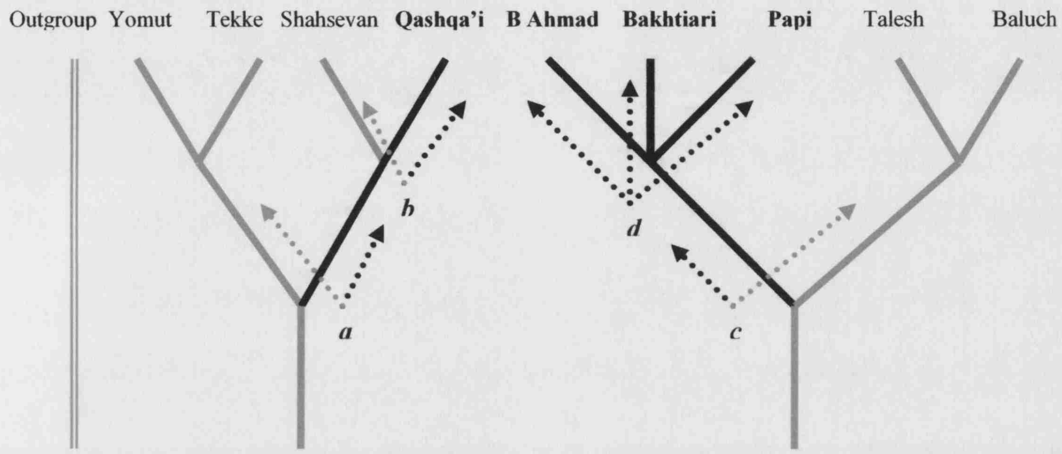
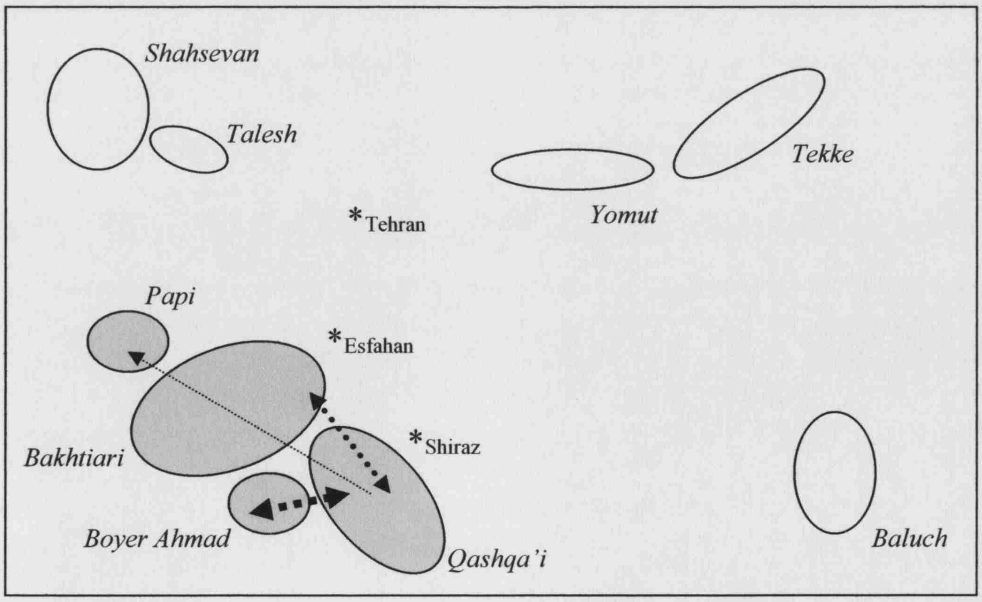


Fig 29: Reciprocal cultural exchanges (dotted arrows) between the Papi, Bakhtiari and Boyer Ahmadi with the neighbouring Qashqa'i. The relative width of the dotted arrows represents the extent of borrowing and blending among Zagros populations. Thus, the Qashqa'i and Boyer Ahmad appear to have engaged in frequent cultural exchanges, whereas the Papi borrowed fewer traits and did not influence Qashqa'i craft traditions.



In summary, the hypothesis that Iranian tribal craft assemblages embody multiple patterns of inheritance was investigated in relation to the cultural evolutionary processes which gave rise to similarities resemblances between them. The relative contributions of descent from ancestral populations, horizontal transmission and independent invention to generating resemblances between the assemblages were determined by a detailed examination of the linguistic and geographical distributions of 86 shared traits. Less than one third of resemblances (30%) between the assemblages could be explained by vertical transmission alone, while the distributions of over 40% of traits indicated that craft traditions of different origins were exchanged and blended between neighbouring groups. The distributions of the remaining traits were not fully consistent with either linguistic affiliations nor geographical proximity, suggesting that they included instances of independent invention. These results supported the hypothesis that Iranian tribal craft assemblages and the resemblances between them were generated by multiple cultural evolutionary processes which cannot be described by a single phylogeny. However, the relative contributions of each process varied between individual assemblages: contrary to the model of multiple patterns of inheritance, the craft traditions of the Yomut and Tekke are descended from ancestral populations and do not appear to have been influenced by other groups. Nor do those of the Baluch, who, like the Yomut and Tekke Turkmen, are isolated from the other populations included in the study. There is some evidence of horizontal transmission between the unrelated but geographically proximate Talesh and Shahsevan, but both these groups' craft assemblages appear to have evolved primarily by descent from ancestral assemblages. The evolution of the Qashqa'i, Boyer Ahmadi, Papi and Bakhtiari assemblages, however, appears to be more complex. As predicted by the model of multiple patterns of inheritance, resemblances among these assemblages reflect both the descent of the populations which produced them, as well as their interactions with one another. The next chapter will investigate the extent to which cultural traits acquired from different sources comprise distinct and coherent traditions, as implied by the notion of 'packages', or whether traits are transmitted and blended together on an individual basis.

CHAPTER 6

Multiple Packages? Units of Descent, Assimilation and Recombination in Iranian Tribal Craft Traditions

6.1 Introduction

Having assessed the extent to which Iranian tribal craft assemblages are rooted in multiple sources of inheritance, this chapter focuses on the second main prediction of the 'multiple packages' hypothesis. Proponents of the hypothesis (e.g. Boyd et al. 1997; Shennan 2002; Shennan & Collard – in press) claim that, rather than borrowing and blending individual traits, populations acquire groups of integrated traits, or 'packages', from ancestral and neighbouring populations. These packages represent distinct and coherent units of cultural inheritance which remain stable over time and space. The integrity of these units over long historical periods and/or large geographical areas could be maintained by a number of factors, such as the technical or functional interdependence of the traits comprising the package (e.g. a set of subsistence skills and technologies relating to the exploitation of a particular resource), or their symbolic connections to one another (e.g. a set of conventionalised behaviours and roles performed in fulfilment of a specific ritual) (Boyd et al. 1997; Shennan & Collard – in press). It has also been suggested (e.g. Bettinger and Eerkens 1999; Shennan 2002) that packages might be adopted and maintained through 'indirect bias', whereby learners copy all the attributes of a successful individual or cultural model, rather than discriminating between individual traits.

Boyd et al. (1997) have remarked that in order to identify potential packages "the essential problem is to determine the boundaries of the domains and establish that they are stable in time and space" (Boyd et al. 1997:366). This problem was addressed in relation to correlations among the distributions of craft traits shared among Iranian tribal populations listed in Tables 2 - 4. Once groups of correlated traits have been established, an examination of their contents will attempt to explain the reasons for associations between the traits. True packages are likely to consist of traits that are either functionally interdependent, or connected to specific craft traditions (e.g. tent-making, carpet designs and techniques, tablet-weaving, etc.). The logic of this approach can be illustrated using a hypothetical example in which two linguistically related populations, *P1* and *P2*, have inherited a number of traits from a common ancestor shared with several other populations, including *t1*, *t2* and *t3* – all of which relate to making felt. Although the distributions of the other traits suggests that they too are primitive, their co-variance among the taxa is inconsistent because they were not all inherited by all the groups, discarded, or replaced by traits borrowed from neighbouring groups. However, *t1*, *t2* and *t3* always occur together, because they are transmitted as an integrated tradition of felting, rather than as three independent traits. Moreover, an unrelated population adjacent to *P1* has borrowed *t1*, *t2* and *t3*, along with several other traits, which, unlike the assimilated package (*t1-t2-t3*), have recombined with pre-existing craft traditions. The *t1-t2-t3* felting package would therefore be an example of a tradition that remains coherent in its transmission both from one generation to the next and between contemporaneous groups. In other cases, packages may be inherited from an ancestral population as a single unit, but break down into individual elements when transmitted horizontally. In the hypothetical example used here, this process would be demonstrated if another neighbouring population had borrowed *t1*, but not *t2* and *t3*.

6.2 Trait Distribution Patterns

Forty-eight patterns of distribution were identified for the 86 characters recorded in Tables 2 - 4, which excluded traits which were uninformative about the evolutionary relationships between the assemblages. Twenty-eight patterns related to individual traits and 20 described the distributions of more than one trait. The distribution patterns included resemblances arising from cultural transmission and those resulting from instances of independent invention. Since the predictions investigated here relate specifically to the stability of cultural traditions acquired from either ancestral or neighbouring populations, the latter were excluded from the data.

Consequently, 5 traits which are likely to have been acquired through independent invention alone (rows 17 – 18 & 22 - 23 in Table 4), were discarded from the analysis.

When instances of independent invention were excluded from the data, a total of 34 patterns accounted for resemblances between the remaining 81 traits shared among the assemblages. The distributions of each trait or group of traits are represented by the network diagrams in Figs. 30 - 33. In each diagram, populations that share linguistic affiliations and are therefore likely to be related by common ancestry are listed vertically, connected to a node by oblique lines or branches. If the trait is also shared with unrelated, neighbouring populations, these are listed in a parallel column which is connected to the former group by a horizontal line. Figs. 30 & 31 list the thirteen patterns related exclusively to the distributions of individual traits - less than half the number returned when resemblances arising from instances of independent invention were included in the data. This suggests that most of the resemblances between the assemblages that related to the distributions of individual traits were generated by independent evolution. It is also noteworthy that most of the patterns relating to the cultural transmission of individual traits describe the distributions of decorative traits (n = 8), with only five describing individual technical traits. This supports the assertion (Chapter 4) that designs are more likely than techniques to be acquired on an individual basis: Firstly, whereas technical traits are generally learned from a single source (usually the learner's mother) at a young age, new designs are learned throughout a weaver's lifetime. Secondly, while a number of techniques are structurally interdependent (since the manufacture of a particular textile requires the use of several techniques, such as spinning, knotting and finishing a carpet), the individual elements or motifs used in textile patterns can be modified and replaced.

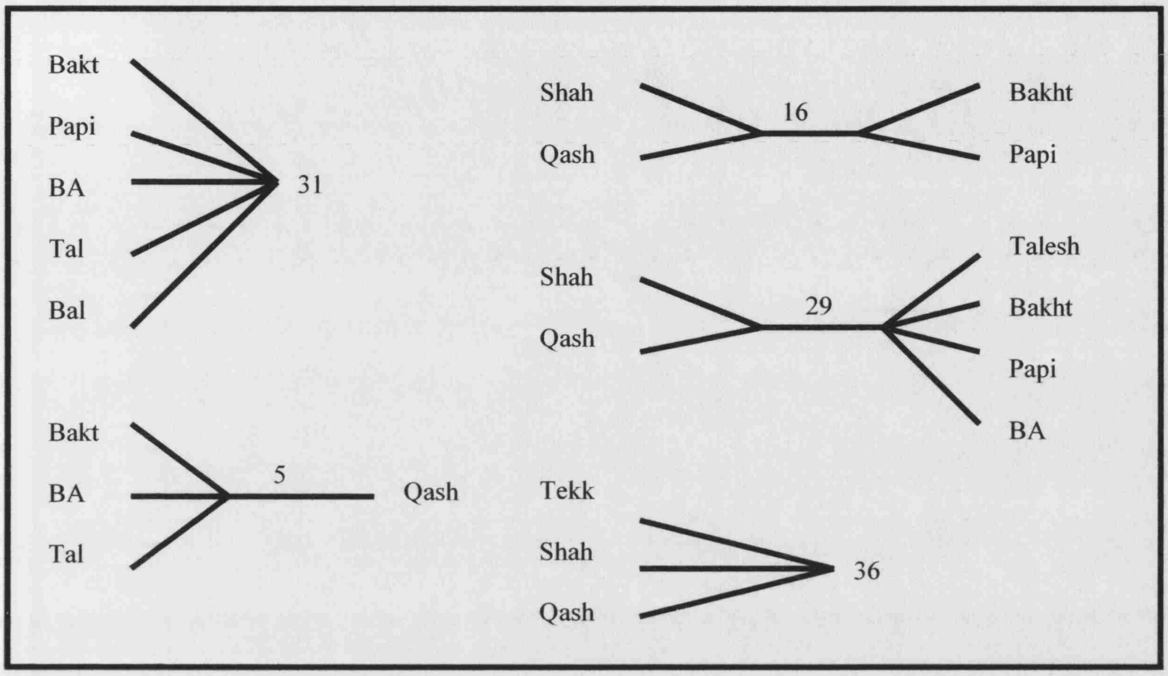


Fig 30: Trait distribution patterns for individual technical traits. Each technique is represented by a character number (see Appendix A2) and has a unique distribution that is described by a network diagram. In the diagrams, linguistically related taxa are linked by branches connected to a node, indicating that the trait was acquired by inheritance from a common ancestral population. The horizontal lines connected to the nodes indicate transmission between unrelated populations. Thus, the Bakhtiari, Boyer Ahmad (BA) and Talesh are believed to have inherited character 5 'cotton spinning' from a common ancestral (Persian-speaking population), whereas the Qashqa'i are likely to have acquired this trait from a neighbouring group (either the Bakhtiari, Boyer Ahmad or a population ancestral to them).

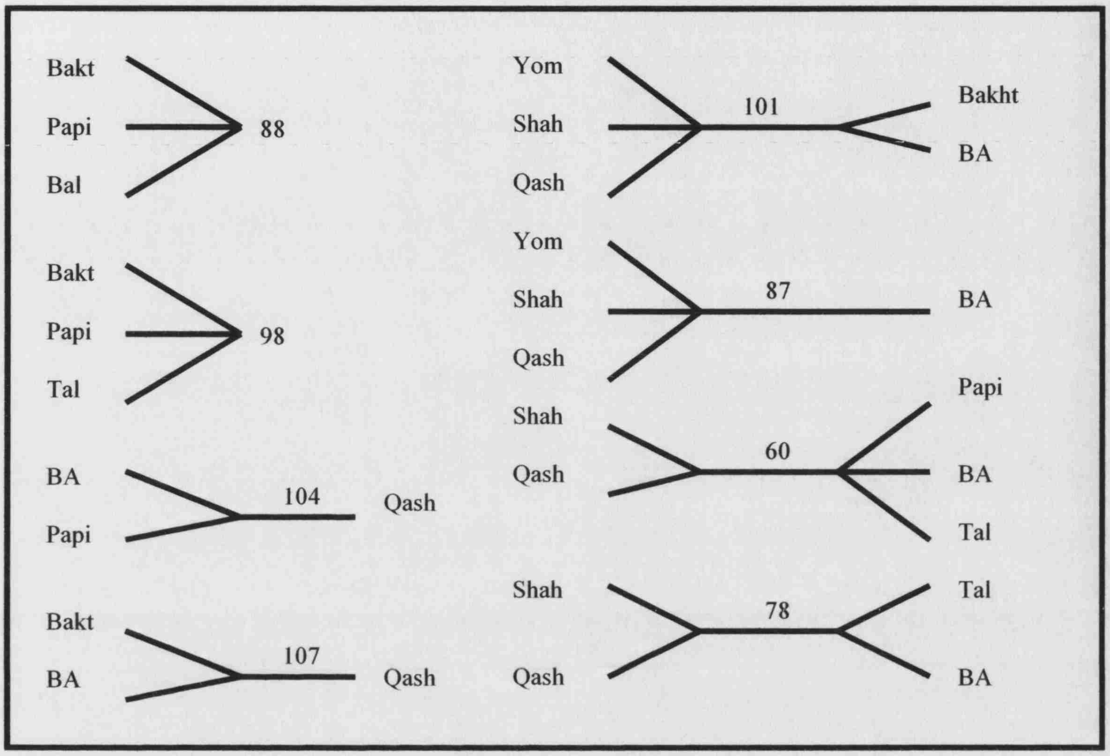


Fig 31 (above): Trait distribution patterns for individual decorative traits. As in Fig 29, each design is represented by a character number and has a unique distribution represented by a network diagram. Linguistically related populations that share the trait are connected by branches, the nodes of which are connected by a horizontal line to unrelated populations that are likely to have acquired the trait by borrowing processes.

Twenty-one patterns accounted for the distributions of the remaining traits (n = 68). These are presented in Figs. 32 & 33. Each of these patterns represents a group of correlated resemblances, ranging in size from two to eight traits. The fact that a large majority of traits fall into correlated patterns of distribution suggests that populations are likely to acquire more than one trait from any single source of cultural inheritance. Fourteen patterns describe the distributions of 44 traits that were identified as being Turkic in origin (Fig. 32), while six patterns describe the distributions of 22 traits originating among Persian-speaking populations (Fig. 33). One further pattern, which includes two traits shared between the unrelated Qashqa'i and Boyer Ahmad is also represented (Fig. 33), although it is not clear which of these neighbouring groups invented the traits. The large number of patterns can be accounted for by the relatively small size of most trait groupings: only four of the distributions represented in Fig. 32 and two of those represented in Fig. 33 include more than three traits. With one exception (a group of eight traits originating in a Lor-speaking group ancestral to the Bakhtiari, Papi and Boyer Ahmadi which were all borrowed by the Turkic-speaking Qashqa'i), all of the traits included in these larger trait groupings appear to have been transmitted by descent from ancestral populations. The majority (12 out of 14) of the smaller groups (two to three correlated traits), on the other hand, link unrelated populations who appear to have acquired traits from one another through processes of horizontal transmission. This suggests that only small units of associated or potentially inter-related craft traits remain coherent over time *and* space. The implications of this finding are discussed in relation to specific trait groupings shared among Iranian tribal populations in the following section.

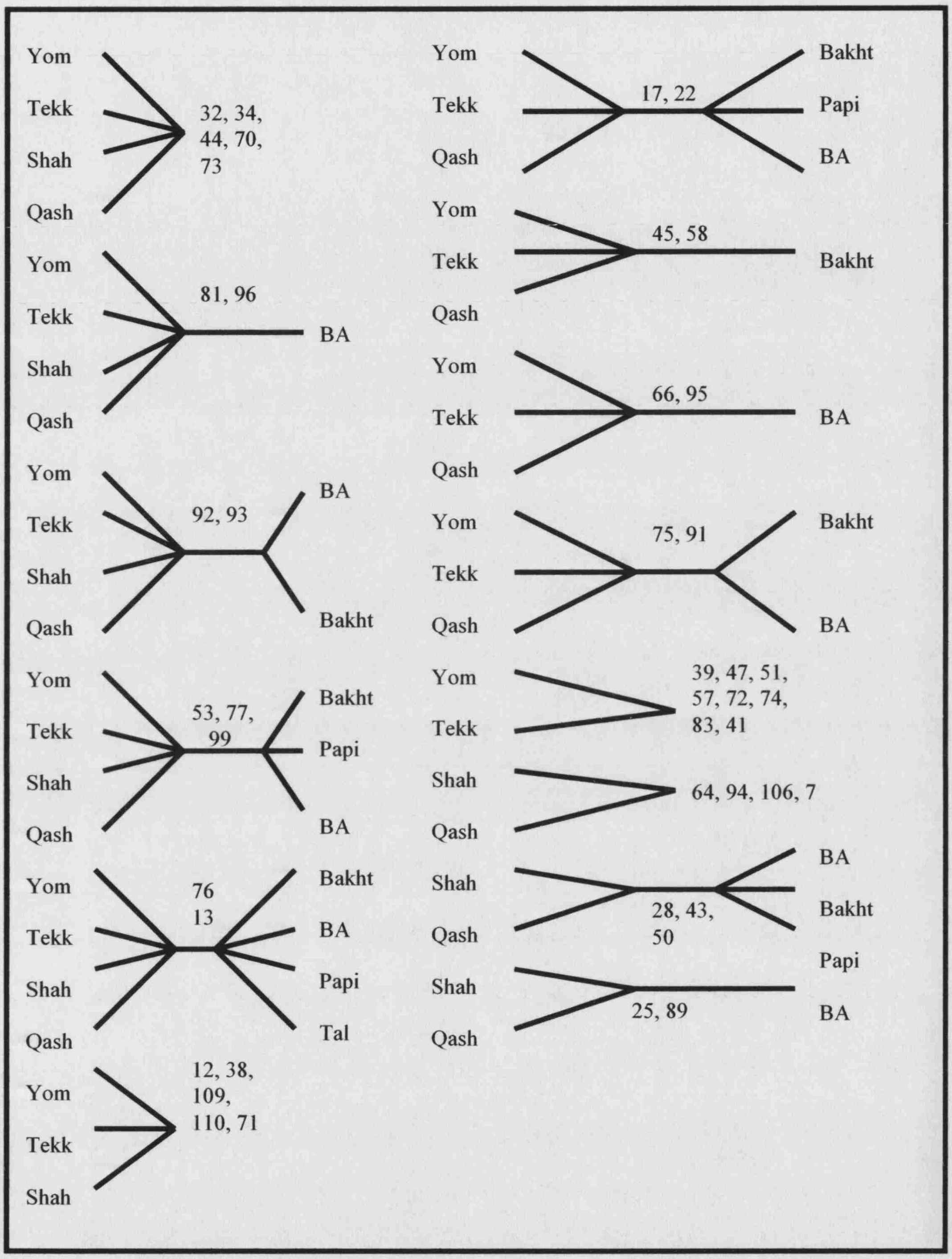


Fig 32: Groups of traits of Turkic origin that are described by the same distribution patterns. Traits are represented by a character number (see Appendix A2) and grouped together in each network diagram, as described in Figs 30 & 31. The content of each group was then investigated to examine whether they represented true 'packages' of inter-related traits that were acquired as integrated units of cultural inheritance or whether they reflected instances of parallel transmission (i.e. traits acquired independently from the same source).

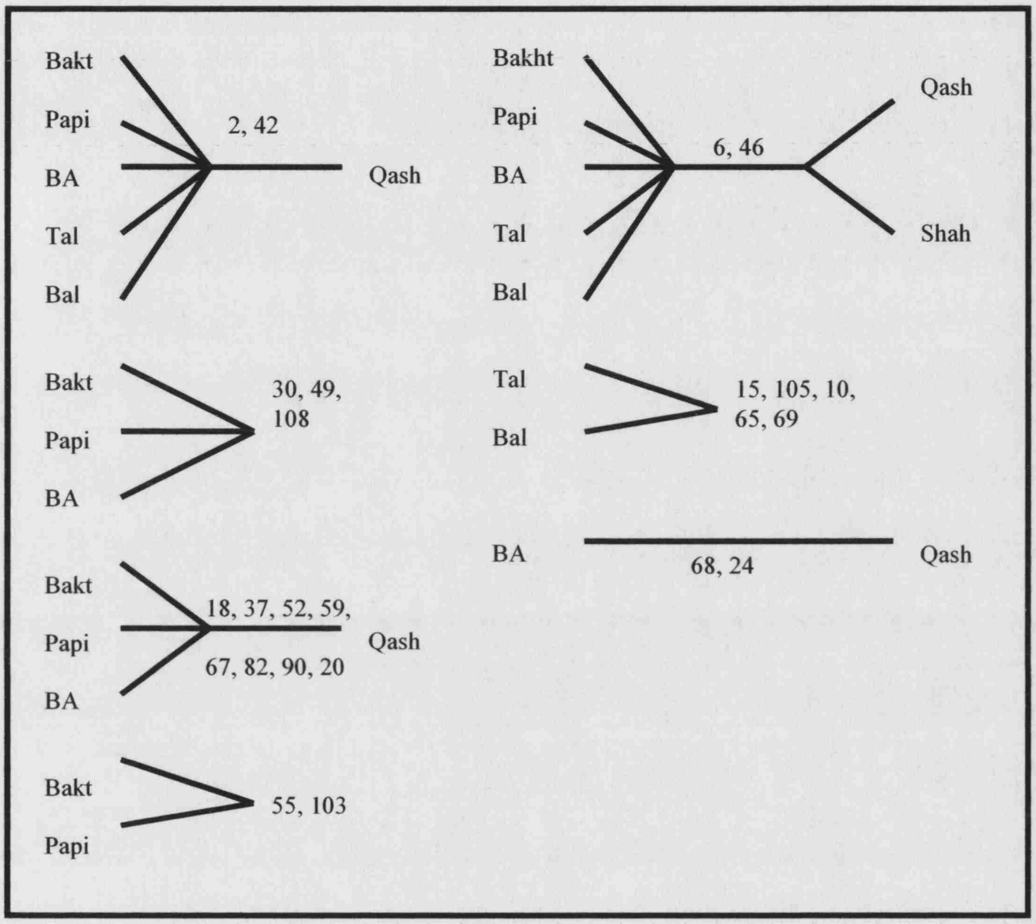


Fig 33: Groups of traits of originating in Persian-speaking groups that are described by the same distribution patterns. Traits are represented by a character number (see Appendix A2) and grouped together in each network diagram, as described in Figs 30 & 31. These groupings may represent 'packages' of cultural inheritance or may result from parallel transmission. Both possibilities are discussed in section 6.3 below.

6.3 Craft Packages and Their Evolutionary Histories

The previous chapter examined sources of cultural inheritance for nine Iranian tribal craft assemblages in relation to the linguistic and geographical distributions of the traits shared among them. However, it is difficult, based on this information alone, to establish whether traits originating from the same source were acquired as an integrated unit, or on an individual basis. The relationships between trait distributions presented here provide a basis for differentiating between genuine packages and traits with parallel histories (i.e. traits adopted from the same source on separate occasions). According to the logic outlined previously, traits that are interdependent or comprise a stable, coherent craft tradition can be identified when their distributions are consistently correlated across several or more taxa. These groups are likely to have been acquired as a single unit of inheritance, or 'package'. Temporary or coincidental groupings of independent traits, on the other hand, are more likely to disintegrate or reticulate with other traits, and thus not be consistently correlated.

On this basis, it cannot be assumed that the five traits that the Talesh appear to have adopted from the neighbouring Shahsevan (trait 13 'felt carpet', trait 29 'warp-faced flat-weaving', trait 60 'row patterns', trait 76 'eight-pointed stars', and trait 78 'eight-pointed star version 2'), which were discussed previously, comprise a package. This is because most of these traits do not consistently occur together among the taxa which exhibit them: although three of the four traits (29, 60 & 78) probably originated in a single source – namely, a common ancestral population of the Shahsevan and Qashqa'i – and are all associated with flat-woven textiles, the distribution of each is unique (Figs. 30 & 31). Trait 29 'warp-faced flat-weaving' is the most widely distributed of these derived traits, having been adopted by the Talesh and by the three Lor-speaking populations which neighbour the Qashqa'i – the Bakhtiari, Papi and Boyer Ahmadi. However, only the latter two groups adopted trait 60 'row patterns', which they may even have invented independently, since these relatively simple patterns are easily produced by flat-weaving techniques (in which designs are created by weaving weft yarns in rows across the warp). The introduction of eight-pointed star motifs (character 76) into the Talesh design lexicon is correlated with the distribution of felt carpet-making (character 13), both of which are shared with all the Turkic-speaking groups as well as with the Bakhtiari, Papi and Boyer Ahmad (Fig. 32). However, this correlation is likely to be coincidental, since these two traits are not functionally related, nor do they belong to the same material culture domain. The version of the 8-point star motif borrowed by the Talesh from the Shahsevan, on the other hand, was adopted by the Boyer Ahmad but not by either of the other two Lor-speaking populations which neighbour the Qashqa'i. The lack of any correlation between the distributions of these traits suggests that, rather than representing a coherent flat-weaving tradition that was assimilated intact, each trait was acquired independently by the Talesh as a consequence of prolonged contact with the Shahsevan.

In contrast, the distributions of the two traits (traits 6 'corded wool' & 46 'flat-woven saddle-bag') that appear to have been adopted by the Shahsevan from the Talesh are consistently correlated among the assemblages in which they occur, which include all the other Persian-speaking populations as well as the Qashqa'i (Fig. 33). This indicates that these two technical traits might constitute a single unit of inheritance, or 'package'. However, since the skills required for cording wool to make guy ropes and flat-weaving for making saddle-bags are completely separate and are not functionally inter-dependent, it is not clear why these two traits should be associated with one another. Instead, it seems that they probably represent elements of a more integrated tradition relating to the craft techniques associated with indigenous Iranian groups which were selectively assimilated by the Shahsevan. If so, this tradition probably included the use of goat hairs to make textile selvages (character 31), which is exclusive to the Persian-speaking populations (Fig. 32), as well as two further traits which were adopted by the Qashqa'i, who are linguistically related to the Shahsevan, but geographically adjacent to the Persian Lor-speaking Bakhtiari and Boyer-Ahmad: character 2, 'woven goat hair', which is associated with the black-goat hair tents used by Persian-speaking groups and distinguished from the traditional Turkic round felt tent used by the Shahsevan, Yomut and Tekke (character 12); and character 42 'basket-making'. It can be speculated that the Qashqa'i adopted these traits, as well as characters 6 and 46 as an integrated package, whereas the Shahsevan selectively assimilated the latter two. However, since they are not consistently correlated, the possibility that the Qashqa'i adopted the traits on account of their individual utility, rather than their collective interdependence, cannot be excluded: it has been hypothesised that the light, portable black goat-hair tent is more suited to the ecology of the Zagros mountain range and the long, steep migration routes used by the Qashqa'i and their Lor-speaking neighbours than the heavier, traditional Turkic felt tent (Feilberg 1944). Similarly, the technique of basket-making may have been learned independently of the other techniques associated with Persian-speaking groups, the materials for which may not have been as readily available in Shahsevan territories.

One further group of eight correlated traits were probably acquired by the Qashqa'i from their Lor-speaking neighbours (Fig. 33). Unlike those discussed previously, these traits are derived traits that the Bakhtiari, Papi and Boyer Ahmad inherited from a common ancestor of more recent origin than the ancestor linking them to other Persian-speaking populations. Four of these traits relate to a design tradition typical of nomadic pile-woven carpets in the Zagros region: character 59 'medallion design', character 67 'diamond medallion', character 82 'bird S-border' and character 90 'reciprocal C-border'. Carpets with the medallion design feature a large ornament which dominates the central field, and is commonly shaped like a diamond. Both bird S-borders and reciprocal C-borders are among the patterns used to decorate the border of the field and feature a series of interlocking motifs reminiscent of a spread-eagled bird and reciprocal arcs woven in alternate colours respectively. Although medallion carpets do not always feature these borders, which are also used on different types of carpets, it is conceivable that these traits were acquired as elements of single design tradition. It is also possible that the medallion tradition was assimilated with a technical trait, character 20 'symmetrical pile knots', the distribution of which is correlated with the medallion design traits and is also associated with pile-woven carpets.

However, since the Qashqa'i make medallion carpets with both asymmetrical and symmetrical knots, the association between these traits might be coincidental. Parallel transmission seems to be the most likely explanation for the other three traits included in the group, which are unlikely to be part of this package since they relate to other domains of the material culture assemblages. Thus, character 37 'tent surround' was more likely to have been assimilated with other techniques associated with constructing black goat hair tents. This 'package' would have included the techniques of spinning and weaving goat hair to make the canopy, and cording wool to make the guy ropes which support the tent poles on which the canopy is hung.

The two other traits are likely to have been adopted independently: character 18, '*gabbeh*', represents a rough pile-woven carpet (known as *khersak*, or 'little bear' by the Bakhtiari) which are usually decorated sparingly with small, isolated animal motifs in the filed and simple border patterns. They rarely feature designs resembling the diamond medallion or bird or C borders. The last trait, character 52, 'tied head band' relates to women's clothing. Other traits which the Qashqa'i are likely to have acquired from their Lor-speaking neighbours on an individual basis, rather than as part of a package, include characters 104 'animal heads shaped like arrows', which they share with the Boyer Ahmad and Papi and 107 'boteh' (paisley motif), which they share with the Boyer Ahmad and Bakhtiari (Fig. 31). The distributions of both these traits are unique (i.e. they are not correlated with other traits), suggesting that if they were once part of distinct design traditions, both have since become independent units of transmission and reticulation.

This process is more pronounced among the 29 traits acquired by Lor-speaking populations from the Qashqa'i. The distributions of seven of these traits are unique, suggesting that they were adopted as independent units. The remaining 22 traits are divided into 9 groups, all of which comprise only two – three correlated traits (Fig. 31). The uneven distributions of these traits suggests that, even though they were acquired from a single source, they do not constitute inter-related components of a unified tradition. Nevertheless, it is likely that at least one of these groupings represents a smaller unit of cultural inheritance in which the historical connection between the traits that comprise it probably relate to their functional interdependence: character 17 'pile-woven carpet' and character 22 '2 weft shots' are consistently correlated in the assemblages of the Yomut, Tekke, Qashqa'i, Bakhtiari, Papi and Boyer Ahmad (Fig. 32). Both describe structural characteristics of nomadic carpets, whereby each row of pile knots are separated by two rows of woollen weft yarns threaded across the width of the warp. These pile-weaving traits appear to have been blended with other carpet-making techniques, such as the method of wrapping goat-hairs around the end warp threads to secure the selvages (trait 31), which the Bakhtiari, Papi and Boyer Ahmad inherited from an ancestral population shared with other Persian-speaking populations. Turkic-speaking groups, on the other hand, secure the selvages with two weft cords of alternating colour (character 32). This trait is correlated with character 34 'end-finishes using weft-float brocading', in which patterns are embroidered onto the plain-woven ends of the carpet. Since both traits are structurally inter-related (both relate to finishing techniques), they can be characterised as a package which was inherited from a common ancestral population. However, the wider association between these traits and the pile-weaving techniques used by the Yomut, Tekke and Qashqa'i was not maintained by the Lor-speaking populations who borrowed the latter. This indicates that, rather than copying all the structural traits associated with Qashqa'i carpets through indiscrimate cultural transmission processes - such as 'indirect bias' (Boyd & Richerson 1985; Bettinger & Eerkens 1999) - the Bakhtiari, Papi and Boyer Ahmad selectively assimilated carpet-making techniques and recombined them with pre-existing techniques.

Only four other traits primitive to Turkic-speaking populations (which are present in all their assemblages) were adopted by all three of the Lor-speaking groups: characters 77 '8-point star version 1' and 99 'animal-shaped motifs' are correlated with character 53 'felt cloak'. The inclusion of the latter trait in this grouping is likely to have resulted from parallel transmission, since it relates to a separate domain of the material culture assemblages which is not associated with woven textile designs. Instead, the felt cloak character is more likely to have originated in a tradition of felt-made clothing associated with a population ancestral to the Shahsevan and Qashqa'i that would have also included character 50 'felt cap', a derived trait inherited by both these groups which is also shared with the Bakhtiari, Papi and Boyer Ahmad. Alternatively, both the felt cloak and felt cap characters might represent fragments of a broader tradition of felting, which would have originally included two other characters primitive to Turkic-speaking populations: 13 'felt carpet' and 14 'felt tent'. However, despite the common origin of these traits, the lack of any consistent correlations between them suggests that the integrity of a unified felting tradition has long since disintegrated: as noted previously, the felt carpet trait is present in the Shahsevan, Qashqa'i, Yomut and Tekke assemblages and was borrowed by the Talesh, Bakhtiari, Papi and Boyer Ahmadi, while character 12 'felt tent' is present in the assemblages of three Turkic populations, the Yomut, Tekke and Shahsevan. The latter trait was replaced by the Qashqa'i, who adopted the black goat hair tent, but is correlated with another tent-related trait, 38 'door cover'. Based on Andrews' survey of Central Asian Turkic tents (1997), it is likely that originally, door covers were also made of felt, although in Iran felt door covers are only associated with the Shahsevan (having been replaced by pile-woven covers among Turkmen populations). Nevertheless, the correlation between characters 12 and 38 probably represents a 'package' of Turkic tent-making traits that has remained more stable than the felting tradition in which they may have been originally incorporated.

The distribution of the felt cap character among the Lor-speaking populations' assemblages is correlated with two other derived traits associated with the Qashqa'i and Shahsevan: character 43 'horse trapping' and character 28 'soumak', which is a flat-weaving technique in which the weft encircles groups of warp threads to produce designs. Again, the lack of any obvious relationship between these traits suggests that, rather than constituting a single tradition, the correlation among them is a product of parallel transmission. In other words, these traits were selectively assimilated by all the Lor-speaking groups on account of their individual utility, rather than their interdependence. This process is also evident in the adoption of designs from the Qashqa'i, particularly by the Bakhtiari and Papi. The extent to which the designs, patterns and motifs used by the Boyer Ahmadi Lors are rooted in a distinctively Turkic design tradition was demonstrated by the results of the phylogenetic analysis of decorative traits presented in Chapter 4, which included the Boyer Ahmad taxon in a Turkic lineage (Fig 13). Although this lineage was reasonably well supported (by 61% of the bootstrap cladograms), the distributions of the 24 primitive decorative traits that link the assemblages are described by multiple patterns, which indicates that they do not comprise a coherent or stable design tradition: A total of 11 distribution patterns include decorative traits, only seven of which include more than one decorative trait, while four distributions are unique. The large number of distribution patterns is partly accounted for by the fact that not all the traits associated with a putative Turkic-speaking ancestral population were inherited by descendent populations. For example, Turkic-speaking populations have inherited a repertoire of patterns and motifs for designing the central field of a carpet, which include two traits (characters 109 and 110) relating to a type of ornament known as a *gul* (*Farsi* = 'flower'). Although *guls* feature on Yomut, Tekke and Shahsevan carpets, the Qashqa'i appear to have either discarded both traits, or replaced them with designs acquired from different sources. Other traits have undergone similar 'reversals' in the assemblages of the Shahsevan and Tekke. Overall, the Yomut are included in all eleven patterns (totalling 24 traits), the Qashqa'i in ten (17 traits), the Tekke in nine (18 traits), and the Shahsevan in eight (14 traits).

However, the majority of distribution patterns for Turkic design traits describe processes of vertical *and* horizontal transmission: The Boyer Ahmad are included in eight patterns (totalling 14 traits), the Bakhtiari in six (10 traits) and the Papi in only two (3 traits). When resemblances arising from horizontal transmission are excluded completely, four patterns account for the distributions of all the primitive decorative traits shared by Turkic-speaking populations (1. Yomut, Tekke, Shahsevan & Qashqa'i; 2. Yomut, Tekke, Shahsevan; 3. Yomut, Tekke, Qashqa'i; 4. Yomut, Shahsevan, Qashqa'i). When resemblances arising from horizontal transmission are included, the number of distribution patterns almost trebles: If resemblances with the Boyer Ahmadi Lors are included, three additional patterns are required to account for these trait distributions (5. Yomut, Shahsevan, Qashqa'i, Boyer Ahmadi; 6. Yomut, Tekke, Qashqa'i, Boyer Ahmad; 7. Yomut, Tekke, Shahsevan, Qashqa'i, Boyer Ahmad). The inclusion of the Bakhtiari and Papi requires a further four additional patterns (8. Yomut, Tekke, Qashqa'i, Bakhtiari; 9. Yomut, Tekke, Qashqa'i, Boyer Ahmad, Bakhtiari; 10. Yomut, Shahsevan, Qashqa'i, Boyer Ahmadi, Bakhtiari; 11. Yomut, Tekke, Shahsevan, Qashqa'i, Boyer Ahmadi, Bakhtiari, Papi). Therefore, the multiplication of distribution patterns for Turkic designs can be attributed mainly to the adoption of these traits by unrelated populations. Like the pile-weaving techniques (characters 17 & 22) discussed earlier, it seems that Lor-speaking populations selectively assimilated designs from their Turkic-speaking neighbours, rather than copying their entire repertoire.

6.4 Conclusions

The 'multiple packages' model of cultural evolution consists of two inter-related hypotheses: Firstly, cultural assemblages, rather than being derived from a single ancestral assemblage, embody multiple patterns of inheritance. Secondly, the model predicts that traits acquired from different sources comprise a coherent set of cultural traditions which remain relatively distinct from one another. In the previous chapter, the first of these claims was investigated in relation to the linguistic and geographical distribution of traits shared among the Iranian tribal craft assemblages. These distributions suggested that six of the assemblages included traits acquired from more than one source. These were the Talesh, the Shahsevan, the Qashqa'i, the Boyer Ahmadi, the Bakhtiari and Papi assemblages, all of which resembled, to some degree, those of linguistically related populations as well as those of neighbouring populations. In this chapter, correlations among trait distributions were investigated to establish the extent to which these groups acquired traits from ancestral groups and from each other as integrated 'packages', or on an individual basis. Once resemblances arising from independent invention were excluded, a total of 34 patterns accounted for the distribution of traits shared among the assemblages, 21 of which described more than one trait. The latter comprised instances of parallel transmission and small packages of inter-related traits. Parallel transmission, in which traits are acquired from the same source independently of one another, produces correlations between traits which are not functionally interdependent and cut across material culture domains. Examples of parallel transmission include the correlation between the distributions of felt carpets (character 13) and eight-pointed star motifs (character 76) present in the Shahsevan, Talesh, Yomut, Tekke, Bakhtiari, Boyer Ahmad and Papi assemblages, and adoption of a weaving technique (character 20), textile type (character 18), tent construction (character37), and aspect of women's costume (character 52) by the Qashqa'i from their Lor-speaking neighbours. Genuine packages, on the other hand, comprise traits that are either functionally or symbolically interdependent or relate to the same material culture domain. Examples of such correlations include those between a) pile-weaving (character 17) and the use of two weft shots (character 22), which are present in the assemblages of the Yomut, Tekke, Qashqa'i, Bakhtiari, Papi and Boyer Ahmad, b) felt tent canopies (character 12) and door covers (character 38) associated with the Yomut, Tekke and Shahsevan, and c) medallion carpet designs shared between the Papi, Boyer Ahmadi, Bakhtiari and Qashqa'i (characters 59, 67, 82 & 90).

However, most of the correlations that were identified as packages relate to small numbers of traits (two or three traits) which probably represent fragments of more integrated craft traditions. For example, the two traits which the Shahsevan probably borrowed from the Talesh (traits 6 'corded wool' & 46 'flat-woven saddle-bag') are associated with several other technical traits in the assemblages of the Persian-speaking populations who acquired them from an ancestral group. Similarly, although the Bakhtiari, Papi and Boyer Ahmad adopted pile-weaving techniques (characters 17 & 22) from the Qashqa'i, they did not assimilate the other structural traits associated with Turkic carpet-making traditions. The disintegration of coherent craft traditions under selective assimilation by neighbouring groups is especially notable in the diffusion of designs of Turkic origin throughout the Zagros region. The Persian-speaking groups – in particular the Bakhtiari and Papi Lors, and to a lesser extent the Boyer Ahmadi Lors – did not assimilate the Turkic design tradition in its entirety, but recombined elements of it with their own traditions. The multiplication of distribution patterns for the craft traits shared among Iranian tribal populations suggests that cultural exchanges between these groups were largely characterised by selective assimilation, rather than indirect transmission biases of the type identified by Bettinger and Eerkens (1999) in their study of western American arrow-point forms. Consequently, although the evolution of some of the assemblages conforms to the prediction that cultures embody multiple patterns of inheritance, they do not, in general, fulfil the prediction that traits acquired from different sources represent coherent and distinct traditions that remain stable in time and space.

Although the approach used in the last two chapters has differed from that of preceding ones, the results yielded by each of them have been consistent in one respect: the cultural evolutionary processes that gave rise to the Iranian tribal craft assemblages do not conform to a general pattern that can be accounted for by a single model. Specifically, the relative influences of phylogenesis and ethnogenesis, and the extent to which cultural traditions remain historically coherent, differ for each of the individual assemblages from which the data was drawn. Thus, while the Tekke and Yomut assemblages evolved by descent, which to differing extents also dominated the evolution of the Baluchi, Shahsevan and Talesh assemblages, reticulation between individual and small packages of traits played a crucial role in generating resemblances among the Qashqa'i, Boyer Ahmadi, Papi and Bakhtiari assemblages. This demonstrates that the diversification of Iranian tribal craft traditions cannot be explained by general processes of cultural evolution (i.e. phylogenesis or ethnogenesis), or by constraints inherent to the component parts of their material culture assemblages (for example, a core of weaving techniques and periphery of designs, or specific groups of traits associated with different cultural domains).

Instead, it appears that each of the assemblages evolved under conditions specific to each of the populations associated with them. It has been suggested that geographical factors might be one such condition. For example, the phylogenesis of the Yomut and Tekke Turkmen assemblages must certainly have been partially determined by their relative isolation from unrelated populations, whose craft traditions they were not exposed to. However, if the relative influences of phylogenesis and ethnogenesis were determined by geography alone, it is not clear why horizontal transmission had such little impact on the neighbouring Shahsevani and Taleshi assemblages, but contributed so much to those of the Qashqa'i, Boyer Ahmadi, Bakhtiari and Papi Lors. While in the former case the cultural traditions inherited by both populations have remained relatively coherent and distinct from one another, the extent of reticulation between traits of different ancestral origins among the latter is indicated by both the results of the phylogenetic analyses, and by the complex distributions of the traits shared between these groups. The chapters that follow will therefore consider the role of other factors which might have influenced the inheritance and stability of tribal craft traditions, in particular the political and economic context of craft production among different populations. These will be explored in a comparative study of a single tradition, the 'Persian Garden Carpet', and its historical transformations in assemblages which appear to have been generated by different cultural evolutionary processes: those of the Turkmen tribes in north-eastern Iran, Afghanistan and Turkmenistan, and Bakhtiari communities in western Iran.

CHAPTER 7

Tribal Garden Carpets

7.1 Introduction

Like previous investigations into the phylogenesis/ethnogenesis problem (Welsch et al. 1992; Moore and Romney 1994; Moore and Romney 1996; Collard and Shennan 2000; Jordan and Shennan 2003; Collard and Shennan 2001; Tehrani and Collard 2002; Guglielmino et al. 1995; Borgerhoff Mulder 2001; Hewlett et al. 2002), the results of this case study suggest that Iranian tribal craft traditions evolved through both the bifurcation of ancestral population into new ones and by borrowing and blending between neighbouring groups, the relative contributions of which varies from case to case. Further investigations suggested that these patterns of variation could not be satisfactorily explained by either the 'core traditions' nor 'multiple packages' hypotheses: Comparative analyses of weaving techniques and designs and a detailed examination of correlations among craft traits did not justify the assertion that the evolution of coherent material culture traditions can be explained by intrinsic connections between individual traits or specific constraints on craft learning. The remainder of this thesis will therefore consider whether the relative contributions of branching and blending might be better accounted for by external factors relating to the wider context of craft production among Iranian tribal populations. Specifically, this investigation will focus on the evolution of a single craft tradition, 'Persian Garden Carpets' among two groups of populations: Turkmen tribes in the frontier regions of north-eastern Iran, Afghanistan and Turkmenistan, and groups associated with the Bakhtiari confederacy in the Zagros moutain range of western Iran.

The results of the analyses carried out so far indicate that the relative contributions of branching and blending were significantly different in generating the Bakhtiari and Turkmen assemblages. Garden Carpet designs provide a particularly interesting source of data for exploring this contrast in relation to the social and economic context of craft production among these groups for two reasons. Firstly, both the Bakhtiari and the Turkmen weave Garden Carpets using pile-weaving techniques, which impose fewer constraints on the reproduction of designs than flat-weaving does. Moreover, evidence reviewed in this chapter which relates to the transformation of the Garden Carpet tradition among both groups suggests that these designs are not linked by potential symbolic associations they may have had in in the past. Consequently, it can be reasoned that the transmission of Garden Carpet traits is unlikely to have been affected by any intrinsic constraints.

Secondly, investigating the processes through which variation in Garden Carpet designs among these populations arose is likely to yield insights of broader relevance to how craft traditions associated with Iranian tribal populations were acquired and transmitted. Rather than inheriting the tradition from a common ancestral source, Turkmen and Bakhtiari Garden Carpets are believed to have originated in an urban source (e.g. Gombos 1979; Moran 1984; Bennett 1989a, 1989b; Ford 1989; Stone 1997; Pinner 2004). This theory is supported by qualitative evidence based on comparisons between classical Garden Carpets made in urban and courtly workshops and contemporary Bakhtiari and Turkmen examples, which will be outlined in this chapter. Moreover, it is unlikely that resemblances between the two groups' garden carpets could have arisen from a tribal source since these two groups do not share an exclusive common ancestor (being of Turkic and Persian extraction respectively), nor are they geographically proximate, and are thus unlikely to have had any significant contact. In view of their origins, Bakhtiari and Turkmen Garden Carpets provide a useful test case for investigating the transmission of related cultural traditions in different societies and under different circumstances. Based on the results of previous analyses, it can be hypothesised that Turkmen Garden Carpet designs evolved through branching processes subsequent to their intial adoption. Among the Bakhtiari, on the other hand, it is likely that borrowing continued to influence the diversification of Garden Carpets. In the chapters that follow, these hypotheses, and their wider significance to interpreting patterns of material culture variation in Iran will be explored in relation to phylogenetic analyses of Turkmen and Bakhtiari Garden Carpet traits and ethnographic data relating to the context and mechanisms of carpet production in both groups.

7.2 Garden Carpets of Chahar-Mahal-va-Bakhtiari

Garden carpet designs are uniquely popular in the western Iranian province of Chahar-Mahal-va-Bakhtiari, the traditional summer pasture lands of nomadic Bakhtiari where large numbers of tribesman have now settled. Consequently, garden carpets are frequently given the simple attribution of 'Bakhtiari', although in fact they are also produced by other groups in the region, which include a long-standing sedentary population of Persian-speakers, as well as small communities of Turks, Armenians and Arabs. The label of 'Bakhtiari' is also misleading because similar garden carpets are also produced in urban workshops and village households in other regions of Iran, such as Kordistan in the north-west of the country and in the central province of Qom (Ford 1989; Stone 1997). The particular version of the garden carpet design associated with Chahar-Mahal-va-Bakhtiari is known as *kheshti,* literally 'brick-pattern'. This appellation refers to the organisation of the central field of the carpet, which is divided into a grid of compartments, each containing an ornament (Fig. 34). Garden carpets made in households or tents feature between 3 to 5 columns and 4 to 9 rows of compartments. Among the most common ornaments are weeping willows, roses, shrubs and cypress trees. The field is usually framed by a wide border featuring a scrolling floral pattern, offset by narrower borders consisting of flowers, leaves or stripes on either side.

Fig 34: Kheshti, *or 'brick-pattern' carpet from Chahar Mahal va Bakhtiari. The appellation refers to the organisation of the field design into square compartments, each of which contains a 'garden' motif such as a vine, rosette or willow.*

Although the lower knot density of household/tent weavings expresses these floral patterns in a somewhat more angular form than the finer garden carpets produced in urban workshops, the use of these curvilnear designs contrasts with the geometrical patterns featured on other Bakhtiari textiles. Noting these inconsistencies between traditional nomadic weavings and the garden carpets produced in the region, some researchers (e.g. Opie 1992) have attributed production of the latter to towns and cities of the Chahar Mahal valley exclusively. These towns are populated mainly by a native Persian-speaking population, whose identity and dialect is distinct from the Bakhtiari, although in the past they were governed by Bakhtiari chiefs in the past under a feudal-like system. However, on the basis of my fieldwork I can confirm that garden carpets are also made in Bakhtiari villages and, to a lesser extent, nomadic communities throughout the region. In many of these cases Bakhtiari weavers copied garden carpet designs from 'cartoons', suggesting that the production of garden carpets by these communities might be a relatively recent phenomenon, since the introduction of these templates is associated with the commercialisation of textile production in tribal communities. However, I was also shown several older examples in the bazaar in Shahr-e Kord (the provincial capital) and in villages where carpets originally woven as dowry presents have been inherited by subsequent generations of the household. What was particularly notable about these carpets is that some of them lacked 'corner solutions', meaning that there are breaks in the continuity of border patterns around the the corners of the field. These flaws are characteristic of tent/household weavings in which designs are learned and reproduced by memory, rather than copied from a knot-by-knot template, and suggest that garden carpets were likely to have been part of a locally maintained tradition. One of the main purposes of this part of the case study will be to establish how this tradition was acquired and developed by the Bakhtiari communities who weave garden carpets today.

The *kheshti* design is almost certainly derived from an urban weaving tradition known as the *chahar bagh*, or 'Four Gardens'. The *chahar bagh* carpet is modelled on the layout of a classical Persian garden, in which four square beds, planted with a rich variety of trees, shrubs and flowers, are irrigated by water channels running from a fountain or pond located in the centre of the garden. The earliest surviving *chahar bagh* carpet (dated 1632) is curated in the City Museum in Jaipur, India (Fig. 35), and was probably woven in an urban workshop in Kerman, south-eastern Iran (Ford 1989). The design is believed to have originated in the courtly workshops of the Iranian Safavid Dynasty (A.D. 1502-1722), whose capital in Esfahan is aproximately 120 km from Shahr-e Kord, the largest city in the modern province of Chahar Mahal va Bakhtiari. In view of the proximity of Bakhtiari territories to the Safavid captital, it is certainly possible that garden carpets were woven in Chahar-Mahal-va-Bakhtiari hundreds of years ago. However, the earliest known pieces which can be attributed to the province only date back as far as the mid-nineteenth century (Bennett 1989a, 1989b; Willborg 2002). Nevertheless, garden carpets produced in other regions provide some highly interesting clues about the transformation of the original *chahar bagh* design into modern *kheshti* patterns.

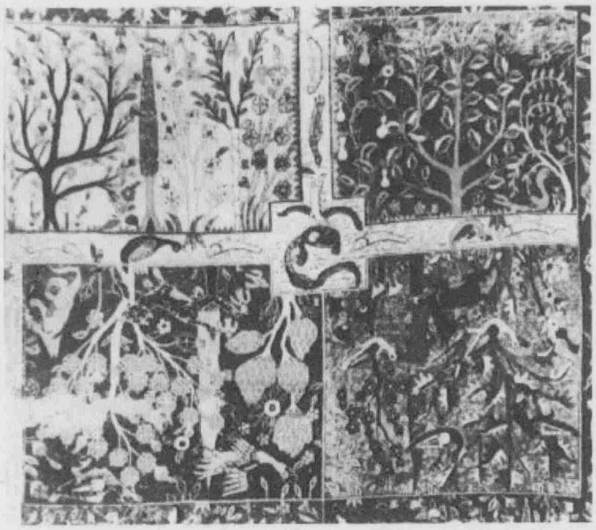


Fig 35: Oldest surviving Chahar Bagh *carpet, curated in the City Museum of Jaipur (Ford 1989) . This carpet, attributed to a seventeenth-century workshop in the Iranian city of Kerman, typifies the classical Garden Carpet design, whereby the field is divided into four 'plots' irrigated by water channels. Both the* kheshti *pattern (Fig 34) and Turkmen* ensi *design (Fig 38) are believed to be derived from this original format.*

Figures 36 and 37 show two eighteenth century garden carpets from north-western Iran. Both carpets exhibit the characteristic *chahar bagh* division of the field into four gardens irrigated by water channels. However, whereas the gardens consist of mixed flora in the Jaipur carpet, these designs are simplified in both of the north-western carpets. In the first one, the four gardens are subdivided again into quarters irrigated by smaller channels. Each plant motif is contained within an individual compartment, rather than as part of an integrated floral pattern. The origins of the *kheshti* 'brick pattern' can be traced to this innovation, which is expressed in a more recognisable form in the second carpet (Fig. 37). In this carpet the smaller water channels have been dispensed with, and the four gardens are represented by larger, more simplified motifs within the compartments. This carpet has a much clearer affinity with 'Bakhtiari' Garden Carpets (e.g. Fig. 34), and although it is not known which group made it, the lack of corner solutions (particularly noticable in the inconsistent spacing of shrub motifs along the vertical main borders) suggests that it was probably produced in a tribal/village community. The simplification of compex floral patterns into individually contained ornaments can be understood in terms of the technological limitations of domestic textile production, in which the memorisation of designs or use of cartoons devised for carpets of comparatively low knot densities (compared to urban workshop products) mitigate against the reproduction of sophisticated patterns. Among the communities of Chahar-Mahal-va-Bakhtiari, this tendency has resulted in the displacement of the four gardens separated by water channels by a grid of compartments covering the entire field. Although the relationship between these carpets and the classical *chahar bagh* carpets is not obvious at first glance, it is surely undeniable when seen in the light of the 'transitional' examples discussed here.

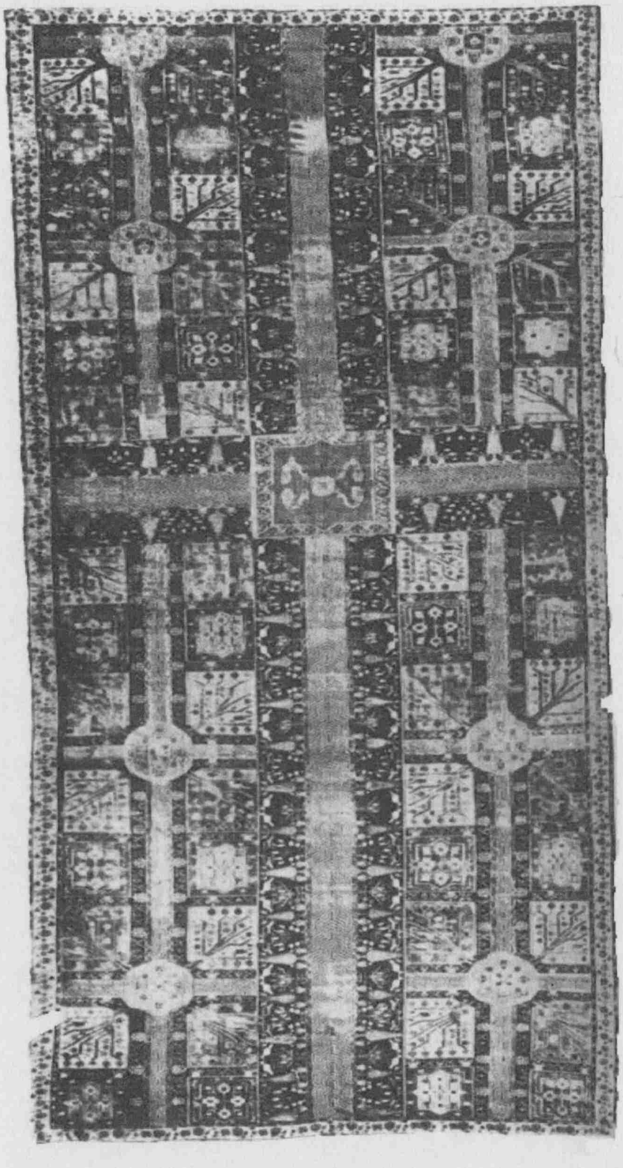


Fig 36: 18th Century North-Western Garden Carpet. After Ford (1989). This carpet represents an early transitional type of Garden Carpet, demonstrating the origins of the kheshti *'brick-pattern' in the classical* Chahar Bagh *design. Like the former type, garden ornaments are contained withing square compartments, but here the water channels and 'quartered' format of the plots are retained from the* Chahar Bagh *field.*

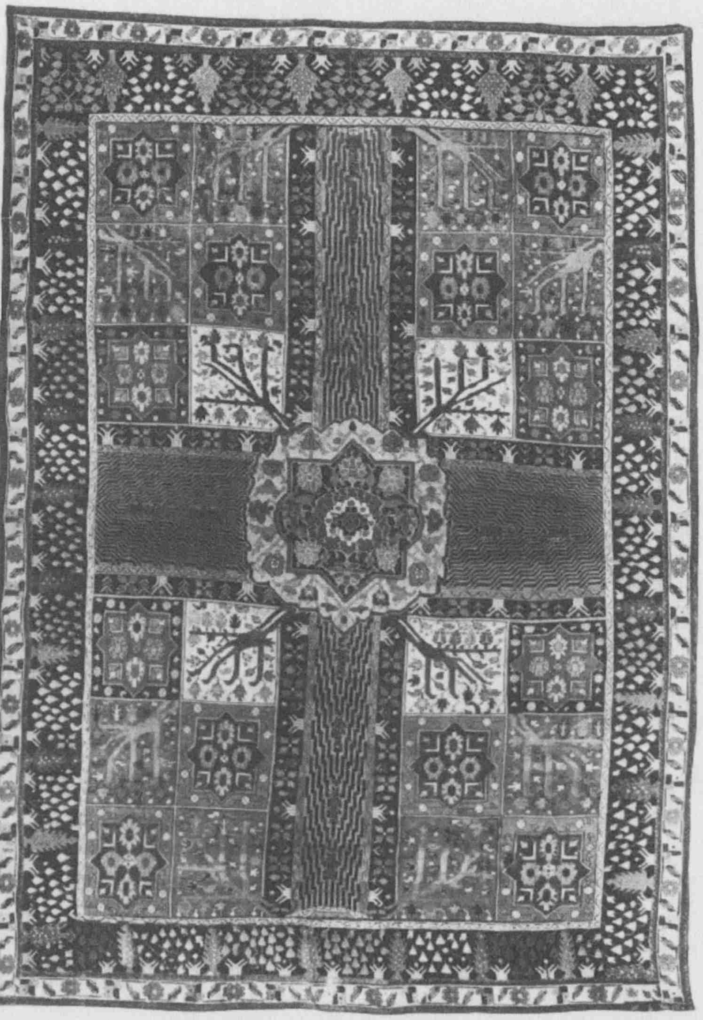


Fig 37: 18th Century North-Western Garden Carpet. After Ford (1989). Another example of the development of the kheshti *pattern from the* Chahar Bagh *design. Here the ornaments are more simplified than the carpet illustrated in the previous figure and the overall impression of this carpet is closer to the modern* kheshti *pattern.*

7.3 Turkmen *Ensi*

Carpets woven by Turkmen tribal populations usually feature rows of repetitive ornaments known as *guls* (derived from the Farsi *gol*, meaning 'flower') on red backgrounds framed by decorative borders. *Gul* patterns dominate the design of many other pile-woven textiles, such as tent bags and storage bags, with the notable exception of a type of artefact known as *engsi* or, more commonly, *ensi*. The uniqueness of *ensi* designs has fascinated scholars and collectors ever since these textiles were brought to western attention in the late nineteenth century, following the publication of the first image of an *ensi* drawn by William Sampson for the *Illustrated London News* in March 1885 (Moran 1984). Although *ensi* patterns used by different Turkmen tribes vary, the general design format consists of a central field divided into four quarters, a number of wide and narrow borders and a decorative end panel, known as the *alem*, at the base of the textile (Fig. 38). One of the most distinctive ornaments used to decorate the field compartments is the *kush*, known as the 'animal-head tree' (Pinner 2004), which commonly features on *ensis* woven by the Tekke, Yomut, Saryk, Ersari and Salor tribes. The design consists of a lattice of intertwined branches culminating in rows of horned animal heads, and is unique to *ensi*. Abstact plant and flower designs similar to those of garden carpets made in Chahar-Mahal-va-Bakhtiari also feature prominently on these textiles, as well as occasional animal and star motifs which are found on other Turkmen weavings.

Fig 38: Turkmen ensi, *Tekke tribes (Thompson 1980). Pile-woven* ensi *were used by Turkmen tribes as a decorative hanging on the the tent door frame. Its design is distinguished from other Turkmen textile products and is believed to be derived from the* Chahar Bagh *tradition.*

Interpretation of these designs, and the peculiar *ensi* format, has spawned a number of theories regarding the origin and purpose of these textiles. Initially, a number of scholars (e.g. Bogolyubov 1908) thought that these textiles might actually be prayer rugs based on the similar size of *ensi* to *namazlyk* (prayer rugs) woven by other groups. Although it has been subsequently established that *ensi*s are in fact usually larger than *namazlyk*s (Thompson 1980), supporters of this view have pointed out that the quartered field resembled the layout of a mosque, some of them apparently including a *mihrab*, or prayer niche, embedded in the border immediately above the field. In other prayer rugs, this niche used to place the head when bowing in prayer, facing the *Ka'aba*. However, etymological evidence provided more telling clues as to the purpose of *ensi*, which is derived from the Turkmeni *öngsi*, meaning 'front cover' or 'apron'. According to research into Turkmen tents (Andrews 1971, 1980) rather than being a type of rug, the *ensi* was originally employed as a door cover, or heavy curtain, fitted to the entrance of the tent frame. It is not known whether they served this function on a daily basis, or, like *kapunuk* decorative door hangings, only on ceremonial occassions. However, despite continued production of *ensi* in the twentieth century, probably for commercial purposes, they are no longer used as door covers, having been replaced by felt and flat-woven textiles (Thompson 1980, Andrews 1980). Nevertheless, the discovery of the original function of *ensi* inspired some collectors to trace the origins of their design in the door panels of palaces in Central Asian cities such as Khiva and Bokhara, although an essay on this subject by the esteemed carpet scholar Gombos (1979) demonstrated that this theory was based on superficial resemblances. More fanciful interpretations (e.g. Hoffmeister 1980) have proposed that *ensi* designs are based in pre-Islamic, shamanistic imagery. Since this particular view is not based on an ethnographically-informed appraisal of the meaning of *ensi* designs to the communities who actually produce them, it can probably be dismissed as an example of the susceptibility of collectors of tribal textiles, with the encouragement of dealers, to 'orientalist fantasy' (Spooner 1986). Spooner's critique of such theories (Spooner 1986) argues that they are products of western assumptions about the superstitious Eastern mind, imbuing textiles with meanings which were probably never intended by the weavers themselves.

Although Turkmen religious beliefs certainly include elements that fall outside the perimeters of orthodox Sunni Islam (Irons 1975; Barthold 1962), *ensi* designs are actually more likely to be derived from Islamic imagery than a putative pre-Islamic cosmology. Arthur Dilley, a collector of Turkmen carpets and lecturer at the Haji Baba Society of rug enhusiasts in New York, was the first scholar to propose that *ensi* designs represented a distinctive expression of the *chahar bagh* tradition, which was itself inspired by a vision of paradise in Quran that promises the faithful "two gardens.... and two beyond" (Dilley 1931). This theory, and elaborations of it (e.g. Thompson 1980, Ford 1997, Pinner 2004), remains the most convincing explanation of the origins of the *ensi* design. Unfortunately, the lack of 'transitional types' makes it impossible to substantiate the theory, or develop a schema showing the development of *ensi* from the *chahar bagh* similar to that outlined in the previous section for Bakhtiari garden carpets. However, the main elements of the *chahar bagh* are evident in Turkmen *ensi* shown in Fig. 38. Unlike the *kheshti* patterns associated with Chahar-Mahal-va-Bakhtiari, the quadrifid division of the field in *chahar bagh* carpets has been retained in the *ensi* format. Instead of multiple flora, each of the four plots is decorated simply with a branching lattice or bush – the famous *kush* design. Other plant and flower motifs, which are not common on other Turkmen textiles, are distributed on the side and end panels, and along the border. In addition to these details, which suggest a garden theme, the pattern used to decorate the channels separating the four 'plots' is strongly remiscent of flowing water. Although believed to originate from a curled leaf design, which features on some Turkmen carpet borders, it is not unusual for weavers in tribal contexts to modify familiar patterns instead of inventing new ones: rosettes morph into stars, shrubs into bushes, fish into leaves (e.g. Opie 1992; Thompson 1980).

In summary, the overall impression of this *ensi* certainly resembles the *chahar bagh*: a field divided into four compartments, separated by water channels, decorated with plant and flower motifs. If *ensi* designs are actually derived from classical Persian garden carpets this would seem to contradict the results of the phylogenetic analyses carried out previously in this case study and in Tehrani and Collard's earlier investigation into the evolution of four Turkmen textile assemblages (Tehrani & Collard 2002), which suggested that these groups' craft traditions evolved by descent from a single ancestral source. These data did not include characters derived from *ensi* designs. It should be noted that the analyses concerned the relationships of these tribes' assemblages to one another and to those of other groups, so did not address the extent to which the development of other tribal craft traditions might also have been influenced by contact with urban society. Although a comprehensive appraisal of the evidence is beyond the remit of this case study, there are strong indications that even the very earliest nomadic textiles such as the famous Pazryrk carpet (Rudenko 1970) imitated urban styles.

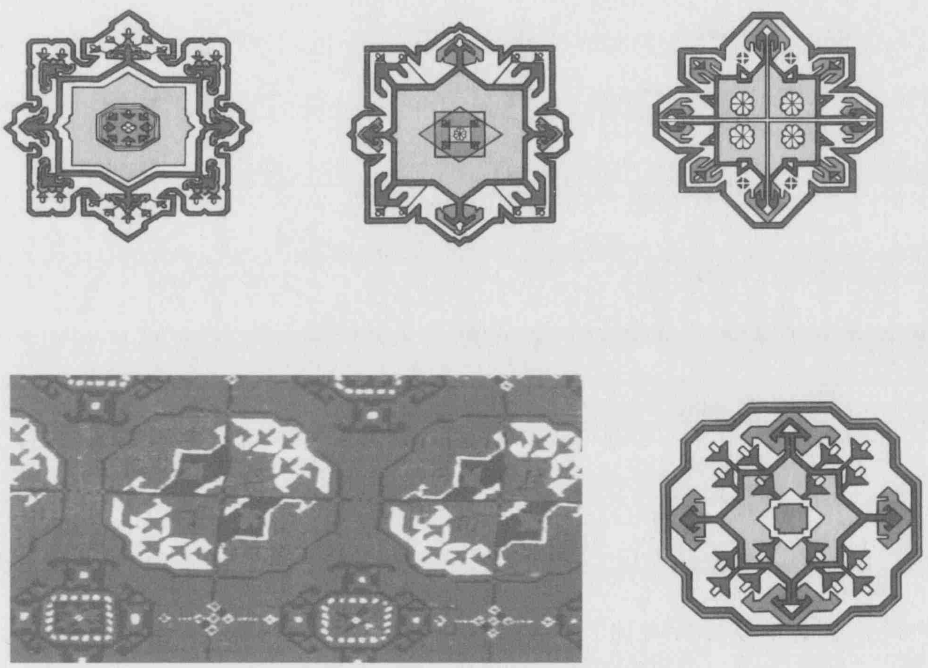


Fig 39: Clockwise from top-left: Transformations of central carpet medallion (top row) to repetitive gul *ornament (bottom left). After Opie 1992.*

In the Turkmen case, several designs appear to be derived from urban traditions, including the distinctive *gul* mentioned previously. According to some researchers (e.g. Opie 1992, Thompson 1980), Turkmen *gul*s evolved from the large ornaments which dominate the centre of 'medallion carpets' (Fig. 39). Specifically, it is proposed that these ornaments became simplified and reduced in size to be employed as a repetitive pattern which was easier to learn and reproduce from memory (a process similar to the develoment of the *kheshti* pattern described in the previous section). Designs acquired by tribal populations from urban sources may therefore be inherited and modified by their descendents in exactly the same way as native traditions. Thus, if garden carpet designs were acquired by an ancestral population of the Turkmen tribes, as *guls* appear to have been (Tehrani & Collard 2002), the diversification of *ensi* designs is likely to follow a phylogenetic branching pattern. On the other hand, it is also possible that the origins and development of the *ensi* tradition might be exceptional in that, rather than having been inherited from an ancestral tribal assemblage, they were acquired more recently and spread throughout the tribes by borrowing and blending. This issue will considered in relation to the results of a phylogenetic analysis of *ensi* sampled from five Turkmen populations and those obtained by Tehrani and Collard (2002) in their analyses of other Turkmen textile designs. Ultimately, however, the main purpose of the *ensi* analyses will be to compare the evolution of this group of designs with the development of Bakhtiari *kheshti* traditions, which will be discussed in Chapter 9 (following analyses of the latter).

CHAPTER 8

Phylogenetic Analyses of Turkmen *Ensi* Designs

8.1 Introduction

The evolution of Turkmen Garden Carpet designs was investigated in relation to *ensi* 'door covers' associated with five populations: the Yomut, Tekke, Saryk, Salor and Ersari. With the exception of some Ersari groups who settled in the emirate of Khiva (Barthold 1962; Wood 1990), these populations were traditionally tent-dwelling nomadic pastoralists, whose territories are shown in Fig. 40. Prior to the Russian conquest of the region in the late 1800s each of these groups represented politically autonomous units, known by convention as 'tribal confederacies' or *Il* (Irons 1974, 1975; Tapper 1979, 1991, 2002; Wood 1990). Turkmen tribal confederacies were defined and internally structured by a patrilineal descent system, through which membership of residence groups (*obas*) and endogamous clans (also *il*) and rights to water and pasture resources were determined (Irons 1975). In theory, all the clans belonging to the same confederacy can trace their relationships with one another through the genealogies of their ancestors (Barthold 1963, Wood 1990), which provided an ideological basis for alliances between them (*Il* also translates as 'relationship of peace' (Irons 1975)). Following a period of Salor dominance in the sixteenth and seventeenth centuries, the Tekke were the most populous and powerful Turkmen confederacy. The defeat of the Tekke and allied tribes by imperial Russian forces at the decisive battle of Gok Tepe in 1881 resulted in the pacification and sedentarisation of the Turkmen, whose indigenous political institutions were subsequently replaced or superceded by colonial rule (Barthold 1963, Wood 1990, Irons 1974). The data sample described here included *ensi* produced both before and after this watershed in the tribes' history.

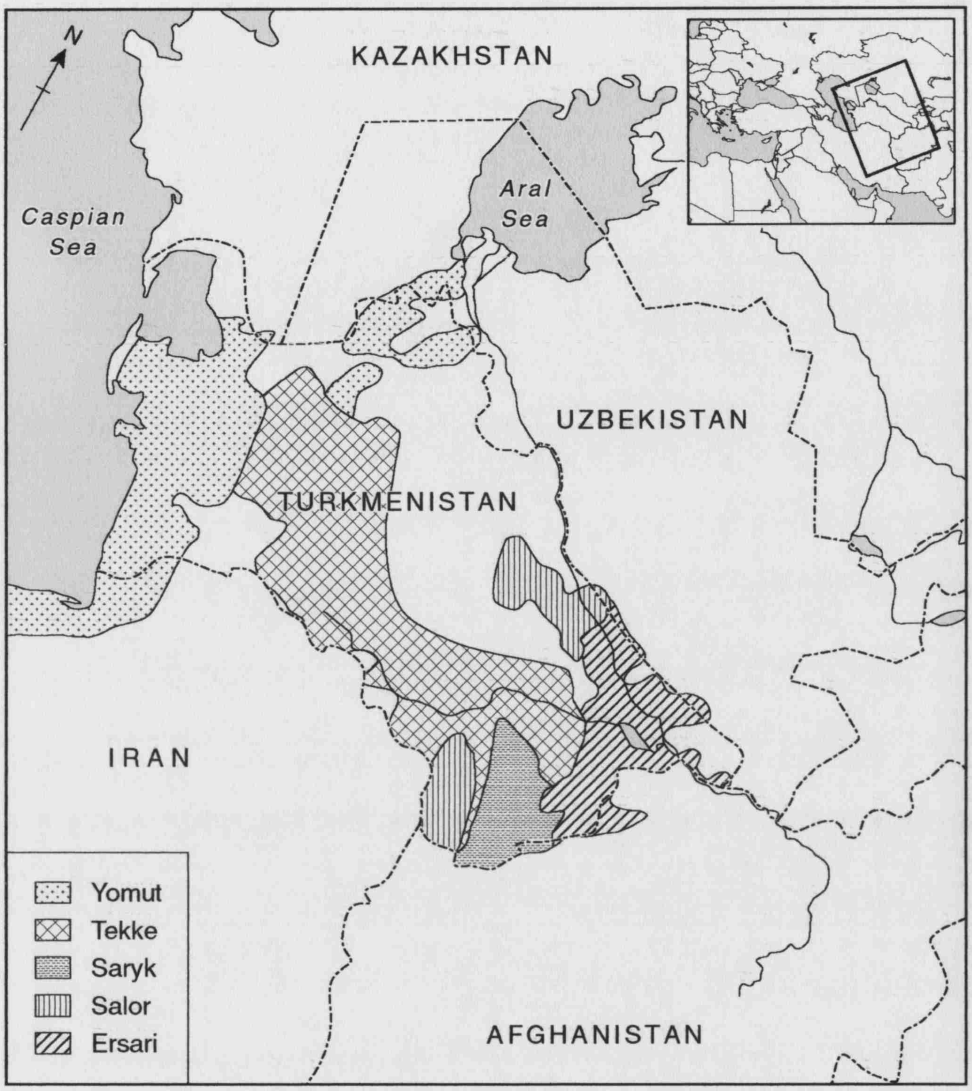


Fig 40:. Map showing territories of the five Turkmen confederacies from which ensi *door rugs were sampled (After Tehrani and Collard 2002)*

Unfortunately, despite the fascination of collectors and textile enthusiasts with Turkmen weavings, no monograph based on a field survey of different tribes' material culture assemblages has been published. However, according to a long-established method (e.g. Thompson 1980, Tehrani and Collard 2002) pile-woven textiles, which include *ensi*, produced by members of each of the tribal confederacies can be distinguished by structural characteristics. These include the type of knot used to tie pile yarns around the warp (Fig. 41), and the relative depression of the warp caused by the tension of the weft shots which pass between each row of knots: The knots used in Saryk and Yomut weavings are looped around two warp threads (symmetrical knot), while Salor, Tekke and Ersari knots are looped around one warp thread and pass under another thread (asymmetrical knot), remaining 'open' on one side. Salor knots are open on the left side, Tekke and Ersari knots are open on the right. The depression of the warp in Ersari and Yomut weavings distinguish them the Tekke and Saryk textiles with which they share the same knot types respectively. Based on this method, seven *ensi*s produced by each tribe were sampled from the Victoria and Albert Museum collection and from published sources on other museum and private collections which included details of the textiles' structural characteristics (Loges 1975; Gombos 1978; Thompson 1980; Hoffmeister 1980; Tzavera 1984; Azadi 1980; Konig 1980; Pinner 1991, 2004). A full description of the sample is provided in Table B1, Appendix B.

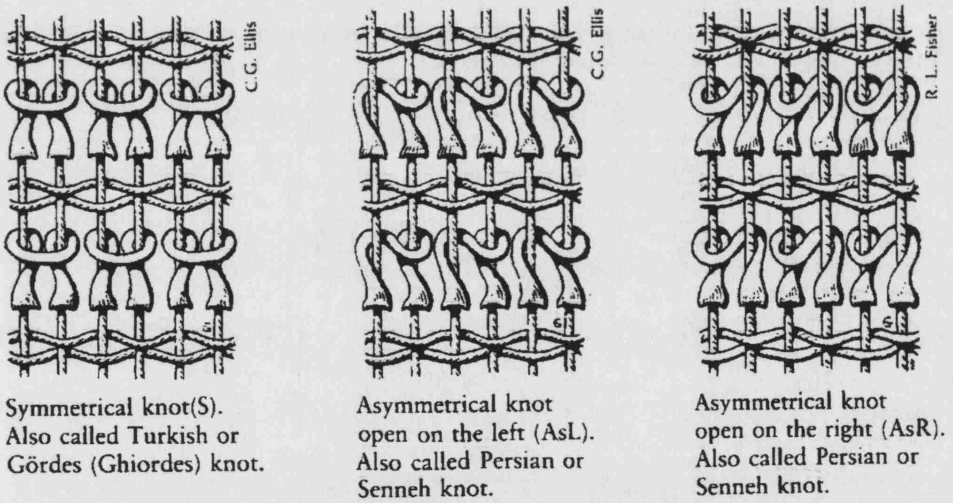


Fig 41: Pile knots used in Turkmen weavings (After Mackie and Thompson 1980). The symmetrical knots employed by Saryk and Yomut weavers are tied around two warp yarns, while the asymmetrical knots employed by other groups are wrapped around one warp yarn and looped under the warp yarn to the right (as in Tekke and Ersari weavings) or on the left (Salor weavings).

Whereas previous data sets that included decorative traits mainly recorded the presence or absence of specific ornaments or motifs, there is a remarkable uniformity in the designs used by different Turkmen tribes to decorate *ensi*. Therefore, the data collected here concentrated more on detailed variations in the designs used to decorate the quartered field (Fig. 42), borders and *alem* end panels. A full list and description of variations such as this is provided in Table B2, Appendix B.

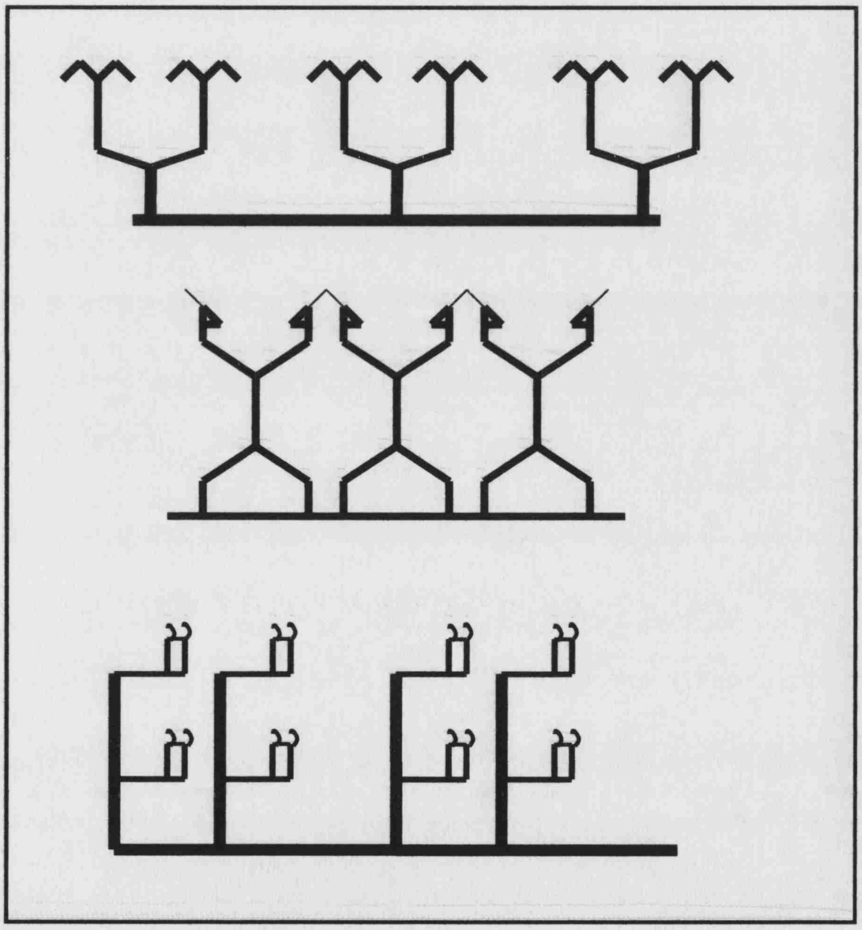


Fig 42: Variations in the kush *'animal head trees' used to decorate the quartered central field of* ensi. *In the top row, branching 'goat horn' motifs are typical of Tekke* ensi *and feature on some Yomut door rugs, while in the second row, animal heads are arranged in profile, as seen in Salor and Ersari weavings. The peculiar arrangement of the* kush *seen in the bottom row are associated exclusively with the Saryk.*

8.2 Analyses

The relative contributions of branching and blending to the evolution of Turkmen *ensi* traditions was investigated through a cladistic analysis of the *ensi* design traits data. Following previous analyses, this was achieved by assessing how well patterns in the data set fitted a tree model. Firstly, the data were encoded in a matrix (Table B3, Appendix B) in which taxa were listed in the row headings, characters listed in the column headings and the presence/absence of each character for each taxon recorded in the cells in a binary fashion. Each taxon represented one of the Turkmen populations whose *ensi* were included in the sample, while 50 characters were derived from variations in the designs associated with these textiles. One further taxon was included as an outgroup. This taxon comprised Bakhtiari *kheshti* designs (Table C2, Appendix C) which, as the previous chapter illustrated, are derived from the same ancestral source and thus represent an appropriate sister taxon. The matrix was then analysed in PAUP 4.0* (Swofford 1998). Firstly, a branch-and-bound search of the data was carried out to determine the most parsimonious explanation for the distribution of resemblances among the taxa using a tree model (Wiley et al. 1991, Minelli 1993, Quicke 1993, Kitching et al. 1998; Schuh 2000). The fit between the data and the optimal cladogram returned by this analysis was then assessed in relation to the Consistency Index (Kitching et al. 1998) and bootstrapping (Felsenstein 1985).

A detailed description of these techniques and the cladistic approach is provided in Chapters 3 (3.3) and 4 (4.2). In brief, both the Consistency Index (CI) and bootstrapping measure the proportion of homologous traits to homoplastic traits (i.e. the number of traits whose distributions are consistent with the optimal cladogram compared to the number of traits whose distributions conflict with it). The closer the CI of the cladogram is to the ideal value of 1, and the higher the support percentages for the clades returned by a bootstrap analysis (based on 100,000 replications), the fewer the number of hypotheses of homoplasy required to explain resemblances among the taxa. Conversely, a lower CI and lower bootstrap percentages would indicate that large numbers of resemblances conflict with the best estimate of phylogeny, and thus arose by processes other than descent. Although the approach taken here is identical to that used in previous analyses of tribal material culture assemblages, its purpose is not to test the predictions of specific hypotheses (e.g. phylogenesis versus ethnogenesis). Instead, the results of the *ensi* analyses will be evaluated in a comparative perspective: Firstly, to what extent does the diversification of *ensi* designs, which were probably acquired from an urban source, conform to the broader patterns of craft diversity among Turkmen populations investigated by Tehrani & Collard (2002)?; Secondly, was the evolution of *ensi* designs influenced by the same processes as Bakhtiari *kheshti*, to which they are related, or did they develop under different circumstances?

8.3 Results

A branch-and-bound search of the *ensi* traits data set returned two equally parsimonious cladograms, the lengths of which both measured 73. The first cladogram contained four clades: the first comprised all the ingroup taxa and divided into two lineages. The first comprised the Yomut and Tekke, the second comprised the Saryk, Ersari and Salor. The latter clade contained one further subclade which linked the Ersari and Salor taxa to the exclusion of the Saryk. The second cladogram also contained four clades, the most inclusive of which comprised all the ingroup taxa. The next most inclusive clade comprised the Tekke, Salor, Ersari and Saryk taxa to the exclusion of the Yomut. This clade contained a sub-clade which excluded the Tekke taxon and linked the Salor, Ersari and Saryk taxa. Nested within this clade was a further sub-clade linking the Salor and Ersari. A bootstrap analysis returned a revised cladogram (Fig. 43) comprising three clades and had a shorter length (= 67) than the two branch-and-bound cladograms. Unlike the latter, which divided the taxa in a strictly bifuracting fashion (whereby each node splits into two branches), the revised cladogram included a trichotomous split (a node that splits into three branches) that divided the ingroup clade into three lineages: the Tekke, the Yomut, and three groups linked by a common ancestor of more recent origin, the Salor, Ersari and Saryk. The shorter length of this tree suggests that a trichotomy represents the most parsimonious explanation for the distribution of resemblances among the groups. The two other clades in the revised cladogram were retained from both the branch-and-bound cladograms. The first linked the Salor, Ersari and Saryk to the exclusion of the Tekke and Yomut, while the second comprised the Salor and Ersari to the exclusion of the Saryk.

The fit between this cladogram and the distribution of resemblances among the five taxa was then assessed in relation to the Consistency Index (CI) and the percentage of cladograms generated from resampled sub-sets of the data by the bootstrap analysis. The CI for the cladogram measured at 0.63. This indicates that more than 60% of resemblances between the five populations' *ensi* designs are compatible with a bifurcating tree pattern. In the results of the bootstrap analyses, the most inclusive clade, comprising the Salor, Ersari and Saryk taxa, was supported by 59% of the cladograms generated from the re-sampled subsets of the *ensi* traits data set. The sub-clade, comprising the Salor and Ersari taxa, was supported by a slightly lower percentage of 54% of the bootstrap cladograms. Thus, although the CI measure indicates that branching dominated the evolution of Turkmen *ensi* designs, the relatively low support given to the clades by the results of the bootstrap analyses demonstrate that blending played a major role in their development.

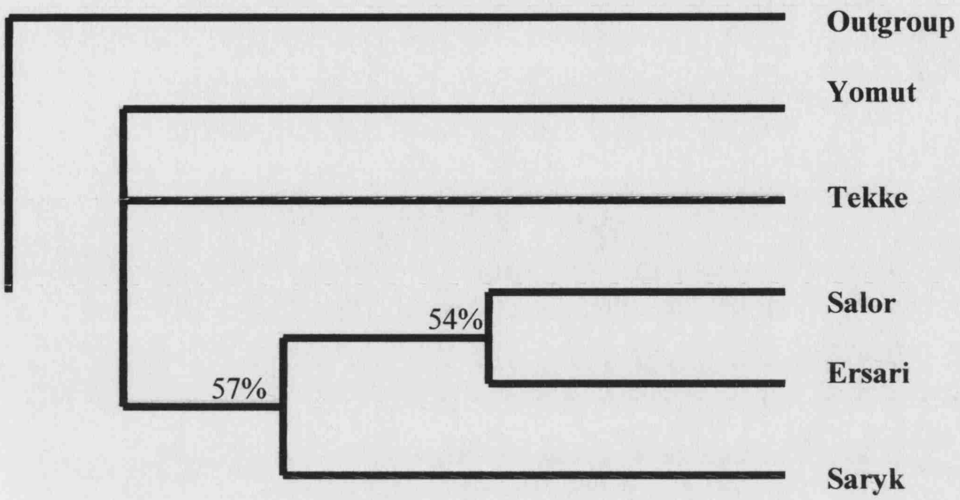


Fig 43: Phylogeny obtained from the Turkmen ensi *traits data set following parsimomy analysis and bootstrapping carried out in PAUP 4.0*. The analyses returned two clades, the bootstrap support values for which are shown beside each node.*

Sources of homoplasy were investigated in subsequent analyses. These examined whether the clade comprising the Salor, Ersari and Saryk was more strongly supported when the Tekke and Yomut taxa were each removed from the data set in turn. The results of these analyses established that, when the Tekke taxon was removed from the data, the clade comprising the Saryk, Salor and Ersari taxa was supported by a much higher percentage of bootstrap cladograms (74%, an increase of 15% on the results of the original bootstrap results), whereas the removal of the Yomut taxon did not result in stronger support for the clade (57%, actually 2% down on the results of the original bootstrap analysis). It can therefore be concluded that although most of the *ensi* designs used by the Saryk, Ersari and Salor tribes were probably inherited from a single ancestral source through branching processes, there is also substantial evidence that some of these groups' designs were borrowed by, or from, the Tekke. It should be noted however, that, in the latter case, independent invention, or the adoption of designs from the same external source (e.g. one of the cities which introduced garden carpet designs to the Turkmen) cannot be ruled out entirely.

8.4 Discussion

The results of the analyses indicate that the diversification of *ensi* designs follows a pattern that is broadly similar to the results of Tehrani and Collard's investigation into other Turkmen textile designs, in which analyses of two data sets were carried out (Tehrani & Collard 2002). The first data set comprised designs featured on carpets and woven bags produced by the Ersari, Tekke, Salor and Saryk prior to the Russian conquest of their territories in the late ninetheenth century. Textiles made during this period can be identified by the use of natural dyes, which were largely replaced by synthetic chemical dyes in the twentieth century (Thompson 1980; Whiting 1980). In addition to these designs, the second data set also included designs featured on synthetically dyed Tekke textiles made in the late nineteenth and early twentieth centuries. The results of the analyses of both data sets indicated that branching dominated the evolution of Turkmen textiles designs in the two periods, although the relative contribution of blending processes increased following the subjugation of the tribes following their defeat by Russian imperial forces. This was indicated by the Consistency Indices of the cladograms returned by analyses of each data set, measuring 0.68 and 0.61 respectively. The latter is comparable to the CI of the cladogram obtained from the *ensi* designs data (CI = 0.63), which also included synthetically-dyed products, but seem to have been marginally less influenced by blending processes.

More significantly, both the cladograms obtained from Tehrani and Collard's data sets included a clade linking the Salor, Ersari and Saryk (Tehrani & Collard 2002). The fact that this clade was also represented in the cladogram returned by the analysis of *ensi* designs suggests that these groups inherited the latter from the same ancestral source as their other craft traditions. The clade was, however, more strongly supported in the results of bootstrap analyses of general textile design data than the *ensi* design data. In the analysis of designs featured on naturally-dyed textiles, 86% of the bootstrap cladograms supported the Salor-Ersari-Saryk clade (Tehrani &

Collard 2002), which is a considerably higher figure than the 57% of bootstrap cladograms which supported the same clade returned by the analysis of the *ensi* design data. However, the latter figure is much closer to the results of the analysis which included designs featuring on synthetically-dyed Tekke textiles, in which the clade was supported by 60% of the bootstrap cladograms (Tehrani & Collard 2002). Further investigation revealed that the increase in the number of homoplasies in this data set probably resulted from the Tekke borrowing designs from the Salor and, to a lesser extent, the Saryk. It seems likely that this trend is also reflected in the recent development of *ensi* designs: the exclusion of the Tekke taxon (which included some synthetically-dyed *ensi*) from a re-analysis of the data resulted in a dramatic increase in the support for the Salor-Ersari-Saryk clade by the bootstrap cladograms (74%, up by 15%). By contrast, the exclusion of the Yomut taxon did not yield stronger support for the clade, suggesting that homoplasies in the *ensi* designs data did not result from borrowing and blending between members of the clade and the Yomut. One further similarity between patterns in the *ensi* data and carpet and bag designs should be noted: the clade comprising the Ersari and Salor returned by analyses of the former was also present in the cladogram derived from the naturally-dyed textiles data set. Again, bootstrap analyses returned stronger support for this clade in the latter case at 63%, compared to 54% in the *ensi* cladogram. Analysis of the data that included designs featured on synthetically-dyed Tekke carpets and bags, on the other hand, did not return a clade linking the Ersari and Salor to the exclusion of the Saryk. This can probably be explained by the increased number of homoplasies resulting from the inclusion of synthetically-dyed Tekke products, which is specifically associated with the adoption of Salor *gul* ornaments and other designs by the Tekke in the period following the Russian conquest (Tehrani & Collard 2002).

It seems reasonable to conclude, therefore, that despite their probable urban origins, the diversification of *ensi* designs is not differentiated from broader patterns of design transmission among the Turkmen tribes. Comparison between the results of the analyses presented here and those carried out by Tehrani and Collard (2002) indicates that the designs used by the Saryk, Salor and Ersari to decorate *ensi*, bags and carpets were probably inherited from a common ancestral assemblage, and that those used by the latter two groups were probably descended from an common ancestor of more recent origin. Unfortunately, it is not possible to directly compare the history of the tribes' craft traditions with their population histories since, to date, no phylogenetic analyses of Turkmen linguistic or genetic data have been published. However, there is some ethnohistorical data on the origins of the five tribes included in the study, and their genealogical relationships. The most widely accepted source is Abu'l Ghazi, who wrote a history of the Turkmen tribes based on their own oral traditions and the 11th Century writings of Rashid al-Din shortly before the end of his reign as Khan of Khiva in 1663 (Barthold 1962, Wood 1990, Jahn 1980). Although Abu'l Ghazi does not date the origins of the Yomut, Tekke, Ersari, Saryk and Salor, he is the first writer to record the existence of all five tribes. In Rashid al-Din's 11th Century history, only the Salor tribe is mentioned (Jahn 1980). This neither confirms that the other tribes arose as independent entities following the introduction of garden carpet designs to the region, but nor does it exclude the possibility that they inherited them from a common ancestor, since the designs are known to have originated in the courtly workshops of the Safavid Dynasty (1502 – 1722) prior to Abu'l Ghazi's reign (the earlist surviving example being dated to 1632), and possibly much earlier than that (Ford 1997).

On the other hand, what is certain is that Abu'l Ghazi's interpretation of the tribes' relationships contradicts the phylogeny derived from the *ensi* design data, as well as those generated from carpet and bag designs associated with the tribes. Whereas these phylogenies all linked the Salor assemblage to the Saryk and Ersari assemblages, Abu'l Ghazi claims that only the Saryk and the Tekke shared actual genealogical connections to the Salor (Wood 1990). However, Tehrani and Collard's assessment of Abu'l Ghazi's genealogy casts doubt on its accuracy as a source of information on the tribes' ethnohistory (Tehrani & Collard 2002). Our skepticism was based on three lines of evidence, the first of which relates to a general theoretical point regarding the ontological basis of oral histories among nomadic groups in the Near East and

Central Asia. Several authors (e.g. Barth 1961, Linder 1982, Tapper 1991, 2002) have noted that, among these groups, for whom kinship, and more specifically patrilineal descent, often provides the major idiom for cooperation, genealogies are frequently and systematically contrived for reasons of political expedience. At the time that Abu'l Ghazi collected his genealogy, the Salor were the most powerful Turkmen confederacy, but evidence from the relative contributions of each tribe to tribute payments to Khiva suggests that the Ersari and Yomut were wealthier and more independent of Salor influence than the Tekke and Saryk. This may account for the exclusion of the former two groups from a Salor-centric account of the other tribes' origins (in which the Tekke and Saryk claimed descent from a Salor lineage). Whether or not this in fact was the case, there are two more specific reasons for doubting the authenticity of Abu'l Ghazi's genealogy. The first reason is based on evidence from the clan names associated with the tribes. Wood (1990) reports that a number of clan names used by Ersari, Salor and Saryk groups are identical, while many others are believed to share etymological roots. Since clan names are inherited patrilineally, this indicates that many of the descent groups (*il*) comprising these tribes share common ancestry. In contrast, the Ersari, Salor and Saryk do not share clan names with the Tekke and Yomut, nor is there evidence that those used by the latter are derived from similar etymological origins (Wood 1990). This supports the phylogenies derived from *ensi* and other textile designs, which hypothesised a lineage comprising the the Ersari, Salor and Saryk to the exclusion of the Tekke and Yomut, and contradicts Abu'l Ghazi's account of the tribes' origins. The latter is also inconsistent with the geographic distribution of the tribes also supports the textile phylogeny. As shown in the map (Fig. 39), the Ersari, Salor and Saryk lived close to the oases at Sarakhs and Bokhara, while the Tekke and Yomut lived in Khorassan. Given that there is a strong statistical tendency for territorial groups to coincide with descent groups (Irons 1974, 1975), this distribution also supports the suggestion that the Ersari, Salor and Saryk are more closely related to one another than they are to the Tekke or the Yomut.

Of course, as has been repeatedly mentioned throughout this thesis, cultural phylogenies do not necessarily coincide with population histories, and – notwithstanding the clan name and geographical evididence - this possibility might be reflected in the contradiction between the ethnohistorical data and the phylogenies derived from the *ensi*, carpet and bag designs data. However, ethnographic reports of craft learning among the Turkmen suggest that the transmission of textile designs is likely to be closely correlated with genetic lineages. In contrast to many other tribal populations in Iran, such as the Qashqa'i and Bakhtiari, nomadic Turkmen weavers among whom Irons carried out fieldwork in the 1960s usually learned designs from their mothers at an early age, without the assistance of cartoons or exposure to weavers from other groups (Irons 1980, 1990). Irons recalls that "they relied on memory to produce the elaborate designs of their carpets as they wove… One woman told my wife that the ability to weave a Turkmen carpet was like literacy. It is a skill acquired over many years, one that beginners can not hope to master in a short time" (1980:35). This type of learning by imitation and memorisation required intense and prolonged contact between teacher and learner. Contact of this quality does not seem to have extended beyond weavers' immediate kin and social group for several reasons.

Firstly, gender relations in Turkmen society are likely to have mitigated against contact between weavers belonging to different tribes since, in accordance with the conservative Islamic practices adhered to by these groups, women were generally confined to the domestic sphere and proscribed from travelling alone (Irons 1975, 1980). Thus, despite the close geographical proximity of the five Turkmen tribes studied here, weavers from different groups are unlikely to to have interacted frequently, or for sufficiently long periods to learn one another's designs. Marriage practices among the Turkmen are also probably a factor in this regard: Although systematic statistical analyses of Turkmen marriage patterns are lacking, Irons (1974, 1975) has estimated that among the Yomut clan endogamy accounted for over 90% of marriages. This suggests that marriage outside the tribe was extremely rare. Support for this is found in Turaeva et al.'s (1985) study of the genotypic frequencies of the ABO and Hp systems in present day

Turkmenistan. Their analyses suggested that the geographical subdivision of the Turkmen populations included in the sample, among them Tekke and Ersari groups, coincided with their genetic divergence, and indicated that gene flow among the tribes has been negligible since their formation. Thus, one of the primary mechanisms of cultural diffusion identified by Moore (2001) – inter-marriage between different tribes and ethnic groups – does not appear to have operated to any significant degree among the Turkmen.

The effects of Turkmen gender relations and endogamous marriage practices on the evolution of their craft traditions can be compared to Neiman's (1995) case study of Illinois Woodland ceramic assemblages, which employed a model borrowed from population genetics to demonstrate how the divergence of the ceramic assemblages increased in proportion to the relative isolation of populations of craft-learners. This is due to a process which has been termed 'frequency-dependent bias' (e.g. Boyd and Richerson 1993), whereby individual assemblages become more homogeneous as a function of random sampling of decorative features by craft learners (since rarer variants are less likely to be imitated and therefore become even rarer). This cultural evolutionary process is analogous to genetic drift in biology, which results from the reproductive isolation of a population from conspecific populations, and has been proposed as a major mechanism of biological speciation (e.g. Mayr 1963, Dobzhansky 1976). It is noteworthy that Durham (1990, 1992) draws an explicit parallel between social institutions such as endogamy and Reproductive Isolating Mechanisms (RIMS) that restrict gene-flow between species. Specifically, he proposes that the former represent Transmission Isolating Mechanisms (TRIMS) that limit cultural exchanges between contemporaneous groups and thereby promote cultural phylogenesis.

In addition to endogamy, one of the other major TRIMS identified by Durham (1990, 1992) which is probably relevant to Turkmen craft evolution is warfare. The prevailing hostility of inter-tribal relations in Turkmen history has been commented on by several authors (Barthold 1962; Wood 1990; Irons 1969, 1974). According to Irons (1974), warfare and feuding were endemic among Turkmen populations prior to their pacification by state governments in Russia and Iran in the late nineteenth and twentieth centuries. Feuding was characterised by tit-for-tat retaliations for sheep raiding or territorial disputes which occurred between residential groups (*obas*) within a tribal grouping. When these hostilities resulted in homicide, the concept of 'blood responsibility' (*qan dushar*) could be invoked by the injured party to exact revenge against any member of the perpetrator's kin related to him by a patrilineal ancestor within seven generations' removal. The 'seven generations rule' did not apply in cases of warfare between tribal confederacies, which often developed from similar disputes over raiding and territory, but were fought by mobilising military expeditions in which any member of the enemy tribe was a legitimate victim. Expeditions were recruited from residence groups (*oba*), who each contributed one out of every five men of fighting age (Irons 1974). The more generalised violence between enemy tribes, whose status as *yaghi* stood diametrically opposed to *il*, 'those with a relationship of peace', was less easily resolved than feuding, in which temporary hostilities could be settled by 'blood revenge' and the subsequent intervention of neutral groups (Irons 1974). The enduring hostility of *yaghi* tribes would have probably limited the frequency and quality of cooperation between different Turkmen tribes, and is likely to have acted as a barrier to cultural transmission between them. Marital and residential patterns associated with feuding, on the other hand, may have been important in maintaining the unity of each tribe's woven assemblages: Irons reports that marital exchanges between households belonging to separate residence groups (*obas*) were used as a means of consolidating alliances forged during times of conflict with other groups, while also noting that most *oba*s had attached contingent of *gongshi*, or 'neighbours' who were often refugees fleeing from 'blood revenge'. These strategies may help explain how designs could have circulated within tribal groups and can be compared to the role of gene-flow in maintaining the unity of a species, without which conspecific populations would become reproductively isolated and diverge.

Several conclusions can be drawn from this discussion of craft diversification among the Turkmen. Firstly, it seems likely that garden carpet designs were acquired and adapted by the Turkmen prior to the emergence of the five tribes included in this study who are first mentioned by Abu'l Ghazi in the 1660s. In particular, the results of the analyses suggests that the Salor, Ersari and Saryk inherited *ensi* designs from a common ancestral assemblage, which incorporated a number of other designs used on these tribes' carpets and bags (Tehrani & Collard 2002). Although the common ancestry of these populations is contradicted by ethnohistorical evidence (Barthold 1962; Wood 1990; Tehrani & Collard 2002), it is consistent with similarities between the clan names used by these groups, and by their geographical distributions. Secondly, although *ensi* designs were, like carpet and bag patterns, transmitted from mother to daughter and probably circulated widely among women belonging to different residence groups, they are unlikely to have been transferred between larger social and territorial entities defined by patrilineal descent. Gender norms in Turkmen society, which prevented women travelling to more distant groups, tribe endogamy and inter-tribal hostilities seem to have acted as effective barriers to horizontal cultural transmission. Whereas in the macro-level analyses conducted in previous chapters it was suggested that geographical isolation was probably an important factor in the phylogenesis of the Tekke and Yomut assemblages, the more localised patterns of craft diversity investigated here, among a group of neighbouring populations, cannot be understood without reference to a more clearly defined social context. To paraphrase the adage coined by Paterson (Paterson 1978, Turner & Paterson 1991) in reference to speciation by reproductive isolation, geographical isolation is neither necessary nor sufficient to generate cultural phylogenesis. Among the factors identified in this discussion, warfare was probably the most significant barrier to inter-tribal cultural exchanges. This conclusion can be drawn from the borrowing of other groups' designs by the Tekke following the Russian conquest of Turkmen territories in the 1880s. This trend, which was identified by Tehrani and Collard (2002) in their study of carpet and bag designs and is also evident in the *ensi* data, does not seem to have resulted from any changes in the tribes' marriage patterns. Genetic studies (Turaeva et al. 1985) carried out in the late 20th Century confirm that gene-flow between tribal groups over the last one hundred years has been negligible. Therefore, it can be reasoned that endogamy alone is not sufficient prevent cultural transmission between groups. The pacification of the Turkmen during this period, on the other hand, appears to have removed a key barrier to cooperation between members of different tribal populations, resulting in an increased contribution of blending processes to the development of their craft traditions. This is obviously an incomplete explanation of the social conditions which promote horizontal transmission. These will be explored in detail in the next chapter, which investigates the diversification of garden carpet designs in the province of Chahar-Mahal-va-Bakhtiari among groups which, according to previous analyses, were more disposed to borrowing from neighbouring populations.

CHAPTER 9

Phylogenetic Analyses of Garden Carpets from Chahar Mahal va Bakhtiari Province

9.1 Introduction

The second part of this investigation into the evolution of the Garden Carpet tradition among tribal populations in Iran focused on *kheshti* ('brick') patterns in the western region of Chahar Mahal va Bakhtiari. Although traditionally governed by Bakhtiari chieftains (the *il-khanis*), the population of the region is not ethnically nor linguistically homogeneous. In addition to Bakhtiari tribespeople and a sizeable urban population of Bakhtiari origin, the region also supports a long-standing sedentary community of Persian-speakers (the Chahar Mahali), migrants from other parts of Iran, Turkic-speaking groups (mainly of Qashqa'i extraction) and Arabs. In the past, Chahar Mahal va Bakhtiari also accommodated significant populations of Kurds, who gave their name to the provincial capital, Shahr-e Kord (literally 'city of the Kurds') and Armenian tradesmen, although both groups have almost entirely disappeared from the province (Willborg 2002; Digard 2001). Today, urban populations, particularly in larger towns and cities, are generally more mixed than rural ones, where members of nomadic communities and villages tend to belong to the same ethnic group and often the same kin group.

Carpets are manufactured in both towns and in villages/camps, and although the *khesti* Garden Carpet design is traditionally associated with the latter (Opie 1992, Housego 1978), I have also observed them being made in a workshop in the city of Shahr-e Kord. However, this investigation focused exclusively on the development of the Garden Carpet tradition among rural populations. Carpets featuring *kheshti* ('brick') patterns – were sampled from four districts of Chahar Mahal va Bakhtiari: Chehelgerd, the central Chahar Mahal valley, Bazoft and Boldaji. Carpets from the area between Feridan and Aligudarz, just outside Chahar Mahal va Bakhtiari, were also included. The geographical location of each district is shown on the map in Fig. 44.

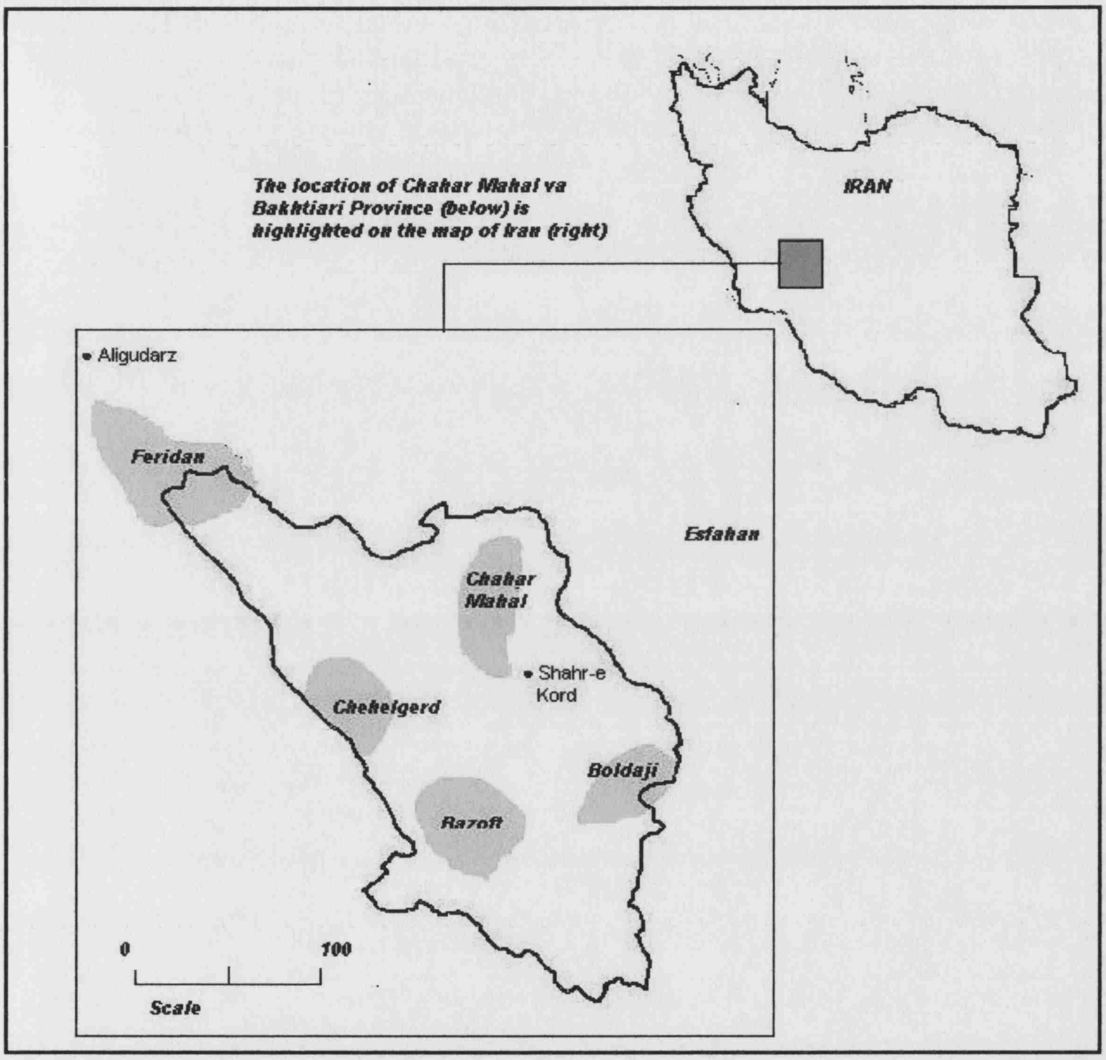


Fig. 44 Map of Chahar Mahal va Bakhtiari Province showing distribution of kheshti-*weaving populations from which data were sampled.*

The 30 rugs sampled from Bazoft, Chehelgerd and between Feridan and Aligudarz were produced by Bakhtiari tribeswomen from villages in these districts, which I visited during two field trips to the region in April – July 2002 and May 2003 respectively. Until recently, most of these communities were pastoral nomads who stayed in the region during the summer months to take advantage of the comparatively cool climate and fresh pastures. Although today most Bakhtiari have settled and practice a mixed economy that includes cultivating crops as well as herding livestock, it is still common for some families to join migrating groups when circumstances require it. For this reason the distinction between 'nomad' and 'villager' is a relatively fluid one. It mainly relates to the economic strategies employed by individual households at a particular given time, rather than permanent occupational or social categories. In this respect the Bakhtiari differ from other groups, such as the Yomut Turkmen, who explicitly differentiate communities according to the contrast between nomadic-pastoralist *charwa* and agriculturalist *chomur* (Irons 1969), or the Qashqa'i, who apply the derogatory term *Tat* (slang for 'Persian') to settled groups (Beck 1986).

Ten carpets from each of the other two populations included in the study were sampled from a survey of Chahar-Mahal-va-Bakhtiari village textiles carried out by Willborg (2002). This survey included *kheshti* carpets made in five villages in the central Chahar Mahal valley and three villages in the Boldaji area. The former are inhabited by a long-standing sedentary population who speak a dialect of Persian, but are linguistically, ethnically and socially distinct from the Bakhtiari, while the latter are populated by sedentary Turkic-speakers who are believed to be of Qashqa'i descent and arrived in the region more recently (Willborg 2002). As with the Bakhtiari, it is not known when these groups started weaving Garden Carpet designs, nor how they acquired them. The ornaments used within *kheshti* tiles were recorded for each group, as well as variations in the details of the ornaments. For example, weavers from all the groups employ the 'weeping willow' ornament, different versions of which classified according to whether they were 'naturalistic' or 'abstract' (Fig. 45). A full description of the sample and design variations is provided in Tables C1 and C2 in Appendix C.

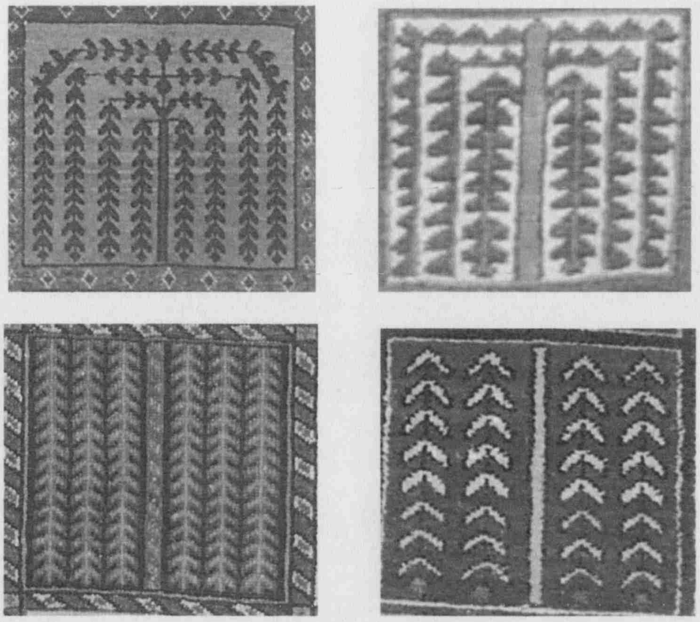


Fig 45: Kheshti *'weeping willow' designs. In the top row, 'naturalistic' version of the ornament are shown, while those in the bottom row were classified as 'abstract'.*

9.2 Analyses

The data sample was encoded for cladistic analyses by constructing a matrix (Table C3, Appendix C) in which taxa were listed in the row headings, characters were listed in the column headings and the presence/absence of each character for each taxon were recorded in the cells. Each taxon represented one of the populations from which *kheshti* carpets were sampled. Three older carpets from north-western Iran were used as an outgroup taxon. As explained in Chapter 7, these carpets are closely related to Bakhtiari *kheshti* carpets and provide the earliest examples of how 'brick' patterns developed from urban *chahar bagh* carpets. According to the logic of cladistics, resemblances between this group of carpets and the in-group taxa can be regarded as primitive. Therefore, the inclusion of the north-western Garden Carpets provides a basis for identifying derived traits inherited by groups from a more recent common ancestor. Fifty characters were derived from variations in the designs associated with the textiles included in the sample. The extent to which patterns in the data conform to this hierarchical, branching model of descent was investigated using PAUP 4.0*. Firstly, a branch-and-bound search of the data matrix was carried out to determine the most parsimonious explanation for the distribution of resemblances among the taxa using the bifurcating tree model (Wiley et al. 1991, Minelli 1993, Quicke 1993, Kitching et al. 1998; Schuh 2000). The fit between the data and the optimal cladogram returned by this analysis was then assessed with the Consistency Index (Kitching et al. 1998) and the support yielded by 100,000 bootstrap replications (Felsenstein 1985). As has been explained previously, these tests measure the number of resemblances among the taxa that are consistent with a tree model (homologies), and thus probably arose by descent, relative to the number of resemblances that conflict with it (homoplasies), which were generated by other processes, such as blending and borrowing. Comparison of these results with those returned by the analyses of the Turkmen *ensi* data will reveal whether the latter were more influential in the development of the garden carpet traditions associated with the Bakhtiari and neighbouring populations, as would be expected from the results of the macro-level analyses carried out previously (chapters 3, 4, 5 & 6).

9.3 Results

The branch-and-bound search of the *kheshti* designs data returned a single most parsimonious cladogram, which is shown in Fig 46. The cladogram comprised three clades, the most inclusive of which hypothesised a common ancestor for the Bazoft, Chahar Mahal, Boldaji and Feridan taxa and excluded the Chehelgerd taxon. Two sub-clades were nested within this clade. The first comprised the Bazoft, Chahar Mahal and Boldaji taxa, while the second clade comprised the Chahar Mahal and Boldaji taxa to the exclusion of the Bazoft taxon. The length of this cladogram (= 71) is comparable to the cladograms obtained by the analyses of the *ensi* data. Although slightly more parsimonious than the two cladograms obtained from the branch-and-bound search of the latter (lengths = 73), the *kheshti* cladogram is longer than the one obtained from bootstrap analysis of the *ensi* data (length = 67).

However, in the key measurements of how well each set of data fits a branching tree structure, the results of the *kheshti* analyses contrast greatly with those returned by the *ensi* analyses. Firstly, the Consistency Index of the *kheshti* cladogram was 0.51, compared to the CI of 0.63 for the revised *ensi* cladogram. This indicates that only a slight majority of traits (51%) were distributed in a fashion consistent with the phylogenetic hypotheses returned by the parsimony analysis of the *kheshti* design data, while almost half of the resemblances between the taxa were homoplastic and thus resulted from processes other than descent. Although independent invention (of Garden Carpet designs from the same original source) cannot be ruled out as a source of homoplasies, it seems likely that within this relatively localised region, borrowing and blending between neighbouring populations was a more important cultural evolutionary process in the development of *kheshti* carpet designs.

Secondly, bootstrap analysis of the *kheshti* data failed to retain any of the clades returned by the branch-and-bound search of the data was retained. This is because each of the phylogenetic hypotheses represented in the cladogram were supported by fewer than 50% of the bootstrap cladograms. The relatively weak phylogenetic signal retrieved by the CI and bootstrap analyses indicates that a large number of resemblances between the *kheshti* designs associated with different populations in Chahar Mahal va Bakhtiari cannot be explained by descent from ancestral populations. Rather, it can be reasoned that borrowing and blending played a major role in the spread of the Garden Carpet tradition in Chahar Mahal va Bakhtiari and were far more influential among these populations than among the Turkmen.

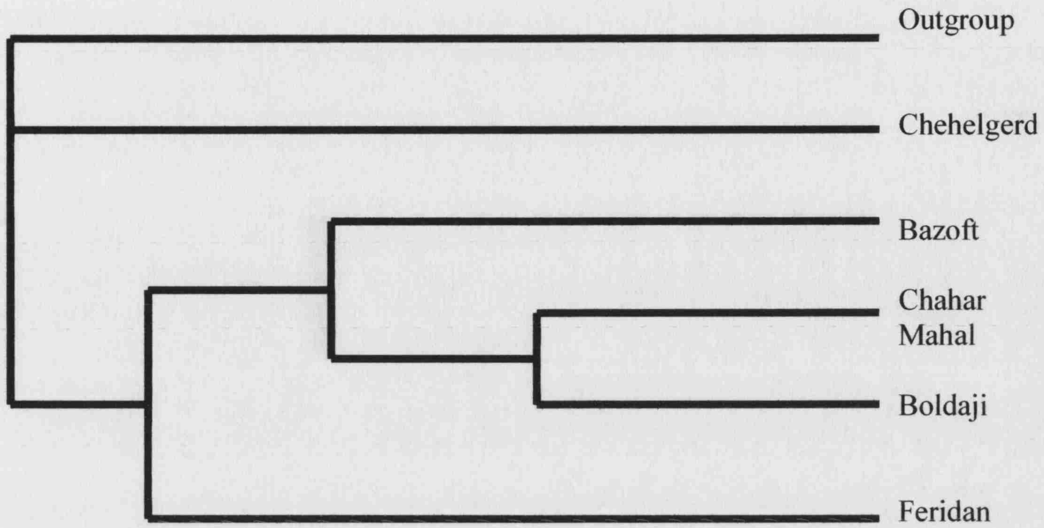


Fig 46: Phylogeny obtained from the kheshti *designs data following parsimony analysis carried out in PAUP 4.0*. Bootstrap analysis failed to support any of the clades represented in the phylogeny.*

9.4 Discussion

The macro-level analyses of Iranian tribal woven assemblages carried out in previous chapters revealed that horizontal transmission made an important contribution to the evolution of Bakhtiari craft traditions: Although the Bakhtiari might have inherited many of the craft traits shared with other Lor-speaking populations from a common ancestral population, these groups' assemblages were also linked to the Turkic-speaking Qashqa'i in the results of phylogenetic analyses of the craft traits data. Detailed examination of the distribution of craft traits shared among these populations supported the contention that their assemblages constitute a 'community of culture' (Jordan and Shennan 2003) that developed through reciprocal cultural exchanges between them. The results of the analyses presented in this chapter suggest that the influence of these processes is amplified on a more localised scale. The extent of horizontal transmission between related and unrelated populations included in the sample was indicated by the failure of the analyses to return significant support for any phylogenetic hypotheses that might have explained the distribution of similar Garden Carpet designs in Chahar Mahal va Bakhtiari.

The results of these analyses contrast with the results of the analyses of the Turkmen *ensi* design data. Although *ensi* designs are probably derived from the same *chahar bagh* Garden Carpet tradition as *kheshti* patterns, analyses of the former returned a phylogeny that was virtually identical to that retrieved from analyses of other Turkmen textile designs and enjoyed similar levels of support. Unlike the Bakhtiari case, Turkmen craft traditions – including those of urban origin – conform to a single pattern of descent. Having proposed several possible mechanisms that inhibited the transfer of textile designs between different Turkmen populations, the discussion that follows will investigate horizontal transmission processes among Bakhtiari populations that are epitomised by the diversification of *kheshti* patterns. Having emphasised the role of the patrilineal descent system in constraining processes of cultural transmission among the Turkmen, particular attention will be given to the social organisation and political structures of the Bakhtiari. Before these can be described, however, it is important to recognise that although larger social entities among both the Bakhtiari and Turkmen are referred to by convention as 'tribes' and 'confederacies', these terms actually denote communities that differ in both size and type. In short, there is no Turkmen equivalent to the Bakhtiari 'confederacy', a complex, hierarchical organisation consisting of multiple layers of leadership and affiliation comprising a total population estimated to be 600,000 (Garthwaite 1983, Digard 2002). Whereas, until recently, the entire Bakhtiari population was integrated into this single confederacy (*il*), since the 17th century the Turkmen have been divided into at least 10 separate confederacies (also called *il*) such as the Yomut, Tekke, Salor, etc., and possibly as many as 20 (Wood 1970). At the turn of the 20th century, the total population of the Turkmen was believed to be one million individuals, at which time Irons estimates the population of the Yomut to have been 60,000 (Irons 1974, 1975).

As well as being much smaller than the Bakhtiari confederacy, Turkmen confederacies differed in character. On the continuum of forms of social organisation among tribal populations in Iran, the Turkmen represent one of the most de-centralised, segmentary groups, while the Bakhtiari are among the most hierarchical and centralised (Tapper 1979, Garthwaite 1983). Irons (1974) has described the political organisation of the former as an 'ordered anarchy' that lacked institutions of centralised authority. Instead, Turkmen residence (*obas*) and territorial (*il*) groups were largely autonomous, cooperating with one another on the basis of consensus between senior male members of patrilineal descent groups (Irons 1974). In contrast, Bakhtiari residence groups (*mal*) were integrated into a pyramidical structure of tribal government, firstly as part of larger territorial units based on descent ties (*tireh*) headed by sub-chiefs (*kadkhoda*), which were affiliated to larger descent groups, or 'clans' known as *tayfeh*. These groups came under the authority of another class of leaders, the *kalantars*, who collectively governed groups of *tayfeh* related by notions of shared ancestry known as *bab* ('sections', commonly referred to as 'tribes'). Each *bab* was aligned with one of the two moieties (*qesmat*), the Chahar Lang and Haft Lang, which together form the Bakhtiari confederacy (*il*). The moieties were heterogeneous in composition and represented administrative divisions of the confederacy, rather than entities defined by genealogical ties. They are believed to have originated for the purposes of collecting taxes from the tribes: specifically, the larger Haft Lang ('seven legs') contributed one-and-three-quarters the number of sheep donated by the Chahar Lang ('four legs') (Garthwaite 1983). The confederacy itself was led by the ultimate source of authority in Bakhtiari government, the *il-khan* and his assistant, the *il-begi*, who were drawn from the two dynastic lineages, both belonging to the larger Haft Lang division of the tribe (Garthwaite 1983; Digard 1981, 2002). Whereas the *kadkhoda*s and *kalantar*s who led Bakhtiari descent groups depended on their internal support base, confederacy chiefs were major players in the national political scene whose authority derived partly from the external support of the Iranian state. Consequently, historians have regarded the *il-khan* as a kind of provincial governor who was as much a feudal overlord as a tribal leader: in return for maintaining order among the nomadic tribes and extracting taxes from them, confederacy leaders were granted ownership over large sections of the farmland cultivated by sedentary populations (Garthwaite 1983).

Given the contrasting natures of the Bakhtiari and Turkmen confederacies, perhaps a more apt comparison could be made between the latter and the largest Bakhtiari descent groups, the *bab*s ('sections'). Although the internal structure and institutions of leadership of the *bab* differs from a Turkmen confederacy, membership of both entities is determined by patrilineal descent, rather than the alternative modes of affiliation which characterise higher level Bakhtiari groupings. It is interesting to note in this regard that Irons' estimate of the Yomut population (60,000) is one tenth of the entire Bakhtiari confederacy (600,000) – which comprises a total of ten *bab*s (Irons 1974, Digard 2002). Although some Turkmen confederacies were larger than others and the size of Bakhtiari *bab*s is also likely to vary, this indicates that the groups from which the data were sampled in the *ensi* and *kheshti* analyses are roughly comparable in population and constitution. In the latter case, each of the Bakhtiari populations from which garden carpet designs were sampled were situated in the territories of different *bab*s: the Mamseleh Bab (Feridan - Aligudarz) of the Chahar Lang division and the Babadi Bab (Chehelgerd) and Doreki Bab (Bazoft) of the Haft Lang division. Given the strong preference for patrilineal parallel marriage (i.e. between a man and his father's brother's daughter), which accounts for between 18 – 43% of all marriages among the Bakhtiari (Digard 2002), and conventions of endogamy within *tayfeh*s ('clans'), inter-marriage between these groups is likely to have been extremely rare. Among rural groups, marriage with non-Bakhtiari groups, such as the Turkic populations of Boldaji and the Persian-speaking villagers in the Chahar Mahal valley from whom data were also sampled, was even rarer. Although, following Durham (1990, 1992), endogamy was identified as a likely Transmission Isolating Mechanism (TRIM) that promoted the phylogenesis of Turkmen *ensi* and other craft traditions, marriage patterns do not seem to have been an effective barrier to the inter-group transmission of *kheshti* designs in Chahar Mahal va Bakhtiari. Although in the absence of genetic studies it is not possible to confirm the extent to which these populations really were endogamous, the ethnographic data summarised above suggests that the movement of individuals between them was negligible.

Although marital exchanges between Bakhtiari descent groups and other populations do not seem to have occurred very frequently, if at all, it is certain that these groups co-operated with one another to a far greater extent than was the case among the Turkmen. Historians and anthropologists (e.g. Garthwaite 1983, Digard 1981, Tapper 1991) believe that the higher-level political institutions to which the Bakhtiari descent groups were affiliated may have evolved partly as a response to encroaching state power in the 18th and 19th centuries, and partly as a creation of it. Prior to this period the Bakhtiari are not referred to in the historical record as a single entity or confederacy, nor are they differentiated from other Lor-speaking tribes. According to Garthwaite, the emergence of a single Bakhtiari entity resulted from two processes, which he terms 'designation' and 'amalgamation' (Garthwaite 1983). Designation relates to the administrative requirements of the state in remote provincial regions, whereby a local leader is appointed with the responsibilities of maintaining order, enlisting conscripts for the army and collecting taxes. As mentioned earlier, the two Bakhtiari moieties of Haft Lang and Chahar Lang probably originated as fiscal entities. Amalgamation, on the other hand, refers to the process by which small, kin-based tribal communities become aligned with one another to pursue common objectives which they could not achieve independently. In the case of the Bakhtiari, the integration of various descent groups into a hierarchical system of command resembled a military entity, with each order of social organisation corresponding to a rank of leaders of increasing seniority. In theory, this system enabled the tribesman to mobilise a formidable army to protect their interests and autonomy at times when these were threatened by other confederacies or an overweening state. In practice, for much of the 19th century, the Iranian government of the Qajar shahs and ruling Bakhtiari dynasty, the Duraki *il-khans*, reached an accommodation whereby the state supported the authority and legitimacy of the latter, as well as granting them additional privileges (over land cultivated by non-tribal populations, for example), but by doing so limited the potential threat posed by the confederacy and maintained a degree of control over the tribes (Garthwaite 1983). Nevertheless, when the opportunity arose, Bakhtiari leaders were willing to extend their influence onto the national political scene by exploiting periods of instability or weak government. Following the Constitutional Revolution of 1905-6, a contingent of 5,000 Bakhtiari was recruited from the descent groups and marched on the capital Tehran to force the abdication of Mohammad 'Ali Qajar Shah in 1909. This show of strength was one of the principal reasons that Reza Pahlavi Shah made a determined effort to undermine and then destroy powerful tribal leaders during his reign (1921 – 1941), a policy followed by his successor Mohammad Reza Pahlavi (1941 – 1979) and the current Islamist regime (Garthwaite 1983; Digard 2002).

Although the Bakhtiari confederacy and its higher ranking leaders (i.e. *il-khani*, *il-beg*, *kalantar*) have long since ceased to be a political force, these institutions provided a context for political co-operation between members of different descent groups that was almost completely lacking among the Turkmen during the same period. The minimal power and influence of the 19th century Iranian Qajar state in the frontier regions occupied by the Turkmen mitigated against the designation of a centralised tribal entity that could be governed by a single leader such as the Bakhtiari *il-khan*. Similarly, there was little motivation for tribal descent groups to compromise their autonomy and amalgamate into larger entities. Instead, the Turkmen were able to exploit the weakness of central government in the region to their advantage by regularly plundering villages and kidnapping their residents to sell as slaves. On the occasions when the state attempted to retaliate with military expeditions, Turkmen nomads made full use of their mobility to flee to remoter areas, rather than organising large armies to defend themselves (Irons 1974). This strategy became unviable following the expansion of the Russian empire into Central Asia in the mid-19th century, forcing a confrontation that culminated in a disastrous defeat at the Battle of Gok Teppe in 1881, which ultimately deprived the Turkmen of their independence (Barthold 1962, Wood 1990). Prior to this, Turkmen tribes fought occasional campaigns against small states such as the Emirate of Khiva, but these were not orchestrated by a central authority or institutionalised leader. As the previous chapter highlighted, relations between the tribes were more usually characterised by mutual hostility, whereby livestock raiding and conflicts over resources frequently escalated into open warfare (Irons 1974). The generalised violence of inter-tribal warfare, in which any member of the enemy group was a legitimate target, contrasts with the more limited and specific acts of revenge carried out in feuding, in which only individual perpetrators or their male relatives were legitimate targets.

Disputes of the latter kind were as prevalent among the Bakhtiari as they were among the Turkmen, and continue to result in homicides and the displacement of families today. However, the higher-level political institutions of the Bakhtiari were able to contain larger-scale conflicts between territorial descent groups that might have escalated into the type of inter-tribal warfare that was so prevalent among the Turkmen. Disputes over migration routes, pasture or water resources would either be resolved by the leaders of the groups involved (e.g. *kadkhodas* or *kalantars*, depending on the size and type of descent group), who were directly responsible for these issues, or when necessary mediated by higher-level authorities (such as the *il-beg* or *il-khan*). Such interventions also occurred on occasions when tit-for-tat retaliation over livestock raiding threatened to escalate. In such cases, the groups involved would lobby their immediate leaders, who, if they could not resolve the dispute, would seek to influence higher authorities to reach a favourable settlement, which usually involved the restoration of stolen animals plus a penalty (Garthwaite 1983, Digard 1981). This quasi-legal system helped to maintain the unity of the confederacy and ensure harmony among its constituent parts. Consequently, one of the principal barriers to co-operation among the Turkmen that probably isolated their craft traditions from contemporaneous influences – warfare between the tribes – was not present among the Bakhtiari. Similarly, the feudal rights gained by Bakhtiari *khans* over farmland provided other sedentary communities in the region some measure of protection from the nomadic population. Whereas the Turkmen were regarded as dangerous barbarians by the Persian villagers whom they in turn despised (Irons 1974; Barthold 1962; Wood 1990), the relative political stability in Chahar

Mahal va Bakhtiari promoted trade and some degree of co-operation between the Bakhtiari and neighbouring groups, such as the Turkic Boldaji and peasants in the Chahar Mahal Valley.

Nevertheless, it seems unlikely that women belonging to different Bakhtiari *bab*s or other communities would have been able to exchange *kheshti* designs or other craft traits directly. As well as being endogamous, residence patterns among Bakhtiari descent groups were patrilocal. Like the Turkmen, the cultural and religious values of the Bakhtiari generally proscribed women from travelling far from their local community, and it is unlikely that they would have had much contact with weavers from other descent groups for sufficiently long periods of time to be taught new carpet designs. Some information regarding the patterns used by different groups might have been obtained from men: Beck relates an anecdote from her fieldwork in the Qashqa'i confederacy in which she describes how "[women] asked men and boys visiting from other camps to describe the weaving of their family members and female kin. Men often examined looms when they visited, out of curiosity, but also to be able to answer other women's questions. They were sometimes the conduit for information about dyes, designs and techniques..." (Beck 1991:123). It is likely that Bakhtiari women made similar inquiries of their husbands, brothers and their male guests. In the communities I visited in Chahar Mahal va Bakhtiari, I was frequently asked to describe the patterns and techniques I had seen used by other groups, and weavers were especially keen to see the sketches I had made and photographs I had taken. One woman in Bazoft even drew copies of some designs that she intended to use in the future. However, as I discovered, it is extremely difficult to accurately describe designs verbally (even allowing for my lack of fluency in their language) without the use of drawings and photographs. It seems unlikely, therefore, that women would have been able to reproduce the complex *kheshti* ornaments used by other groups based solely on the descriptions provided by males who lack the technical knowledge of how detailed designs are rendered. More probably, their curiosity related to how the overall aesthetic impression of other groups' textiles compared to their own weavings. The most useful information in this regard would concern general elements of design, the size and spacing of ornaments, use of colour, etc.

If weavers in different communities in Chahar Mahal va Bakhtiari were not able to exchange designs through direct contact with one another, it is probable that blending between their *kheshti* patterns resulted from *indirect* processes of horizontal transmission. One potential mechanism for the diffusion of carpet designs in the region was the employment of women from tribal and other rural communities in workshops situated in the palaces of Bakhtiari *khans* which were managed by their wives, the *bibi*s ('ladies'). Carpets made in these workshops are known as *bibibaff* (literally, 'lady's-weave'), and have been produced since at least the beginning of the 19th century, and may have even originated soon after the founding of the Bakhtiari confederacy and establishment of a tribal aristocracy (Willborg 2002; Bennett 1989a, 1989b). *Bibibaff* carpets were generally larger than carpets produced in a tent or village context, as well as being of a finer quality. Workshop production was observed by a British female doctor, Elizabeth Macbean Ross, who was employed by a Bakhtiari *khan* in the early 1900s. She describes how the *bibi* personally supervised every stage of production from the selection and preparation of wool to washing, weighing, dyeing and weaving (Macbean Ross 1921). The weavers themselves were the wives of the *khan*'s servants and women employed from local villages and camps on a temporary basis, who worked from sunrise to sunset in exchange for two meals a day and a couple of *toman* (the local currency) upon the completion of a carpet (ibid). They copied designs from drawings (it is not clear whether or not these were knot-by-knot templates, like the 'cartoons' often used today in workshops and households alike), which were often adapted from urban Iranian carpets, English and French textile patterns, which had become popular among the Iranian elite, and probably also *bibibaff* produced in other workshops (Macbean Ross 1921; Bennett 1989a).

*Bibi*s were probably as curious about each other's carpet production as the weavers in camps and villages described above. They were certainly aware of one another's reputations:Macbean Ross reports that the *bibi*s in Ardal and Kaveh Rokh were particularly renowned for the quality of their workshop products (Macbean Ross 1921). However, compared to weavers in camps and villages, the *bibis* had far greater access to and information about one another's work: Hospitality is greatly valued among all sectors of Bakhtiari society, and reciprocal visits between members of the elite probably fulfilled an important political function in enabling leaders to exchange information regarding the government of the tribe and one another's activities. On some occasions, leaders would be accompanied by their wives, particularly when the latter were related to the hosts. Despite the conventions of endogamy among the tribe at large, it seems that marriages between ruling families were not uncommon and many *bibis* shared affinal or kinship links (Macbean Ross 1921; Garthwaite 1983). In accordance with the general rule of sexual segregation in Iranian households when non-family members were present, the *bibis* would have been mainly responsible for entertaining their female guests. It is not difficult to imagine that this would have probably included a discussion of carpet production and a tour of the palace's workshop. Secondly, it is known that Bakhtiari leaders exchanged carpets with one another as gifts: many *bibibaff* carpets include woven inscriptions in the border which record the place, date and names of the donor and recipient involved in these exchanges (e.g. "Be greeted.... By the order of Kaman [possibly a *bab* or *tayfeh,* maybe the name of the village?] to Agha-ye-Mohammad Ali Khan Bakhtiari, 1220 AH [1805 AD]". This particular inscription was woven on a *bibibaff* included in Willborg's (2002) published collection of Bakhtiari carpets). Macbean Ross also observed cases where *bibis* "make their husbands a present of a particularly fine carpet to present to someone they desire to conciliate" (Macbean Ross 1921:106). Thus, the designs featured on carpets produced in Bakhtiari workshops over the last 200 years could very easily have been influenced by either the direct exchange of information between the wives of the *khans* who managed them, and/or inspection of one another's work.

It is likely that some of the designs exchanged between *bibibaff* workshops would have been more widely circulated among the villages and camps from which weavers were employed, despite the lack of direct contact between them. Copying patterns from drawings provided by the workshop exposed these weavers to a new source of designs that they could later use on their own weavings. This process is very much in evidence among weavers from tribal communities who have worked in the commercial carpet workshops that are scattered throughout Chahar Mahal va Bakhtiari today. Interviews with weavers from villages in the Sar-Khune region revealed that employment in the local workshop (Fig. 47), which is owned by an 'Islamic Foundation' (a semi-autonomous state-owned commercial enterprise) and produces carpets for sale in Tehran, is an important source of income for their families. The majority of them were aged between 13 and 30 years old, and had learned to weave carpets from female family members between the ages of six and nine. The workshop provides the weaver with her materials, a loom and a salary, but employees did not earn money from the sale of their carpets, unlike those produced in a domestic context. In general, slightly older women who were married preferred to weave at home rather than at a workshop, so that they could supervise their children. Often, they bought their looms from their salary savings as well as the materials to begin weaving their own carpets, the majority of which are sold to merchants at the local market-place. These weavers claimed that many of the designs they used on their carpets had been acquired from their experience in the workshop, which they were able to reproduce without the aid of drawings or cartoons. Similarly, Macbean Ross observed that *bibibaff* weavers had effectively memorised the designs they were weaving, noting that "they have a pattern before them, but they very seldom seem to look at it" (Macbean Ross 1921:145). However, it should be noted that weavers in Sar-Khune reported that they did not use the designs they learned in workshops on their other textile products, such as saddle-bags. This may account for the stylistic differences noted by textile scholars (e.g. Opie 1992) between the Garden Carpets produced in Chahar Mahal va Bakhtiari, which feature floral, curvilinear designs and the more angular, geometric patterns characteristic of other woven artefacts. It can be speculated that workshops provided both the original source of the garden carpets produced by rural populations in Chahar Mahal va Bakhtiari, and perhaps promoted a greater degree of blending between their *kheshti* designs than occurred between other craft traditions, which might have developed under more isolated conditions.

Fig 47: Workshop in Sar-Khune in Chahar Mahal va Bakhtiari Province (Photographed May 2003). The workshop is managed by a semi-autonomous governmental Islamic Foundation and employs workers from local villages

Although the origins of rural garden carpets remain uncertain, it seems reasonable to assume that, as in Sar-Khune today, workshops were an important source of new designs in rural communities in the past. Initially, weavers in rural communities may have copied designs that were fashionable among the tribal elite for their prestige value. Anthropologists have claimed that, in hierarchical societies, 'taste' is often determined by status aspirations, whereby individuals imitate the sensibilities of the upper classes whilst seeking to distinguish themselves from the lower classes (e.g. Bourdieu 1984). Digard (2002) has proposed that the spread of tea-drinking among the Bakhtiari might have occurred through this type of transmission process. Tea was introduced to the region by the British, who became a major presence in the region following the discovery of oil in Bakhtiari territories in the early 20th Century. The British subsequently became extremely influential as financial and political sponsors of the Bakhtiari *khans*, many of whom became 'westernised' as a result. Apart from adopting European fashions and sending their sons abroad to British public schools, tea drinking became an essential component of the hospitality rituals of the Bakhtiari elite (Macbean Ross 1921; Digard 2002). Despite the protestations of the *khans* – who somewhat disingenuously claimed that the adoption of tea by ordinary tribespeople would make them dependent on a foreign power (Digard 2002) – tea-drinking spread rapidly throughout the region. Digard claims that the former's objection was more likely to be based on their desire to "remain the sole beneficiaries of the tangible manifestations of friendships lavished on the Bakhtiari at the time in a far from disinterested fashion by the English" (Digard 2002:85). However, it was precisely this claim to exclusivity that made tea so attractive to other members of the tribe: today, an offer of a cup of tea is likely to be among the first interactions a visitor to Chahar Mahal va Bakhtiari will have with a Bakhtiari tribesman. A similar process might have influenced carpet-making in the region. In a typically sardonic aside, Macbean Ross observed that the *bibi*s used some English and French designs on their workshop carpets "which they were under the impression the *ferangi* [Europeans] like" (Macbean Ross 1921:146). Macbean Ross specifically cites pairs of large pink roses as an example of such a design, which has now become a fairly common ornament of rural *kheshti* carpets – a section of which is shown in Fig. 48.

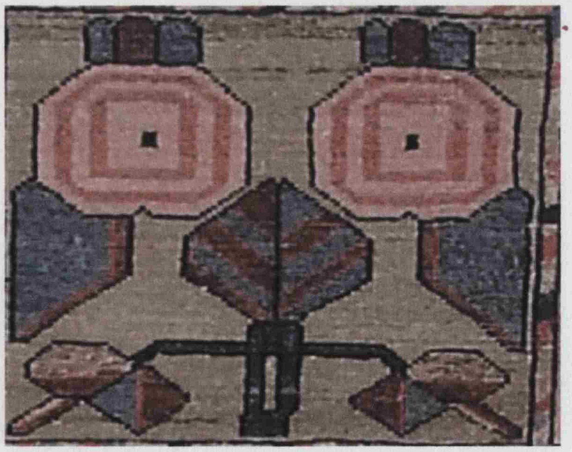


Fig 48: Pair of pink roses in a kheshti *carpet from Feridan. The design probably originates in European textiles and was introduced into communities in the region by* bibibaff *workshops managed by the wives of Bakhtiari khans.*

The spread of designs associated with the tribal elite might therefore be explained by a process that can be referred to as 'prestige bias'. 'Prestige bias' is similar to 'indirect bias' (Boyd and Richerson 1985), which is defined as the indiscriminate adoption of traits associated with successful individuals or groups, rather than the adoption of intrinsically successful traits (e.g. Boyd and Richerson 1985; Bettinger and Eerkens 1999). However, in status-differentiated societies where resources are unevenly distributed, 'prestige bias' is probably more constrained than simple 'indirect bias', since an individual is unlikely to be able to copy all the traits associated with more successful individuals if the costs involved are beyond their means. Thus, although ordinary members of Bakhtiari society may have been able to afford tea, they could not wear clothes made of fabrics imported from Europe, or send their children to British public schools. Similarly, weavers in rural communities could copy some of the designs they learned in *bibibaff* workshops, but probably had to adapt them according to the materials and technologies available to them in camps and villages. Some patterns that were woven in silk or fine wool on large workshop looms from cartoons and drawings were either too complex to reproduce from memory, or had to be simplified for carpets made from coarser wool on horizontal ground looms with lower knot-densities. According to this explanation, the origins of the *kheshti* 'brick' pattern might be understood as an adaptation of the more complex, floral *chahar bagh* Garden Carpets made in palace workshops in which weavers from rural communities were employed.

Among tribal weavers today, however, the selection of designs is largely determined by a second type of transmission bias: commercial utility. Like workshops, the textile market has been established in Chahar-Mahal-va-Bakhtiari since at least the early 19th century, which historians have noted was a period of active regional trade (Helfgott 1994). By the third quarter of 19th century, merchants based in cities were utilising their control of market-places and local networks to acquire carpets produced by rural communities for export (ibid). The rapid growth of international demand for tribal carpets in the late 19th and early 20th centuries paralleled the increasing obsession of the west for collecting and categorising 'exotic' artefacts (e.g. African art, Indian sculptures, etc.). During this period, rural production of carpets increased throughout Iran, and by the early 20th century Chahar-Mahal-va-Bakhtiari had become one of the most prolific carpet-making regions in the country according to a British survey of the Iranian economy (Helfgott 1994). Leading Bakhtiari families took advantage of this trend by imposing a tax on all textiles sold by communities within the confederacy (including non-Bakhtiari sedentary communities), which supplemented their income from carpets produced commercially in the *bibi* workshops (Macbean Ross 1921; Helfgott 1994). Despite these attempts to centralise the economy of carpet production in the region, the Bakhtiari *khans*' control over rural communities was substantially undermined and eventually lost completely during the last century. Land reform acts, and a concerted effort to modernise Iran politically during the reign of Reza Pahlavi (1921 – 1941), dissolved the autonomy of the large tribal confederacies and the feudal privileges enjoyed by its leaders - many of whom were executed, imprisoned or exiled (Garthwaite 1983, Helfgott 1994). The tribal way of life was regarded as anachronistic and became a target of a government campaign which obstructed their migration routes and attempted to enforce the sedentarisation of nomadic communities.

Although a comprehensive explanation of these upheavals is beyond the present study, one aspect of the economic crisis that gripped these communities during the period of relevance here is their increased dependence on markets and money-lenders to acquire the basic items necessary to their subsistence: sheep and other livestock, tea, sugar, wheat, fees for the use of privatised pasture land, etc. (Beck 1986; Helfgott 1994). According to one commentator, (Helfgott 1994), the monetarisation of the rural economy intensified the financial pressure on rural families, who subsequently became more dependent on the income generated from the sale of carpets that had previously supplemented their main economic activities. In these circumstances, "market conditions encouraged nomadic carpet-makers to introduce new designs, sizes, and production techniques. Nomads continued to make rugs with familiar designs but also introduced elements they thought would appeal to carpet buyers, who were usually agents of the *bazaar* who combed the countryside buying rugs" (Helfgott 1994:172). This is supported by evidence from the contemporary rug-producing communities among whom fieldwork for this project was carried out: Families in camps and villages in Chahar-Mahal-va-Bakhtiari reported that in years when agricultural or pastoral yields were expected to be relatively poor (e.g. as a consequence of disease), commercial production of carpets would be increased to compensate. One family in Bazoft, who were members of the Sheikh Pobot *tayfeh* of the Babadi *bab* (affiliated to the Haft Lang division of the Bakhtiari), epitomised this trend: forced by debt to sell most of their own livestock, the male head of the household now earned a wage as a shepherd for a wealthy pastoral entrepreneur. Instead of joining him on the migration to Khuzestan Province in the winter, this year his wife would stay in the village and weave carpets, which she intended to sell to a dealer in the nearby town of Farsan. Whereas in the past she sold one or two carpets a year, she calculated that her total output – and income – would be more than doubled without the interruption of the migration. It is notable in this regard that textile production in settled communities in the region appears to be more geared toward commerce than is the case among nomads. Whereas the sale of carpets and other textiles by the latter is largely opportunistic, commercial weaving among settled communities is a more established and consistent source of income. In the Chehelgerd district, where nomadic camps are situated close to villages during summer months, the production of pile-woven carpets – which are generally the most commercially valuable textiles – is almost exclusively associated with settled communities, who have largely abandoned other traditional crafts such as tablet-weaving and flat-weaving which the nomads use to make packing bands, saddle-bags, *choogha* coats and other textiles. The specialisation of craft production in the area is reflected in the adoption of vertical looms by settled groups in Chehelgerd (where, according to my survey of 22 village households, they are used by approximately two out of three of the households in which carpets are woven). The size and relative stability of the vertical loom compared to the portable horizontal looms used by nomads allows settled weavers to produce larger carpets decorated with more intricate designs, such as the floral, curvilinear ornaments associated with *kheshti* carpets. The spread of vertical looms among settled groups in Chahar-Mahal-va-Bakhtiari thus represents a striking example of how the integration of rural carpet production into regional textile-markets has promoted the introduction of new production techniques and decorative styles.

Contact between *bazaar* agents and rug-producing communities probably also provided an important mechanism for the indirect transmission of garden carpet and other textile designs between rug-producing groups in Chahar-Mahal-va-Bakhtiari. The merchants' agents to whom weavers sold their products were certainly an important source of information about the weavings of other groups, whose knowledge of the market would have enabled weavers to adopt designs with the greatest commercial utility. Since the latter half of the 20th century, rug merchants have been able to exert this influence more directly by issuing 'cartoons' for weavers to copy from. Cartoons provide a knot-by-knot coloured template of the patterns required by the merchants, who buy the finished article from weavers and sell them on at the *bazaar* for a profit. Today, the distribution of such cartoons is endemic among rug-producing communities in Chahar-Mahal-va-Bakhtiari and many other rural areas in Iran. Weavers from these areas reported that they often use designs they acquired from cartoons on their independent projects, and frequently teach them to female kin and friends. Consequently, designs that have circulated in this way are likely to have spread more widely and more rapidly than those acquired from *bibibaff* workshops in the past or commercial workshops today. Firstly, whereas opportunities to work in these institutions were limited to weavers who lived in nearby camps or villages, who might then have transmitted the skills and designs they learned to other communities in their descent group, merchants and their agents who 'combed the countryside' would have direct contact with almost all rug-producing groups. In Chahar-Mahal-va-Bakhtiari, these certainly included non-Bakhtiari populations, such as the Turkic community in the Boldaji area and Persian-speaking villagers in the Chahar Mahal Valley from whom *kheshti* designs were sampled. Secondly, the incentive to adopt designs with high commercial utility – particularly for members of families who were heavily in debt or otherwise financially desperate – was probably greater than previous motives (e.g. prestige value) to experiment with new patterns.

The latter point has been demonstrated very effectively by Greenfield et al.'s (2000) investigation into the commercialisation of weaving among the Zinacantec Maya in rural Chiapas, Mexico. They report that between 1969 and 1993 the region experienced significant changes, shifting from a subsistence-based economy to one based on commerce and entrepreneurship. Textiles collected during this period suggest that these changes had a profound impact on the community's craft traditions: while the artefacts sampled between 1969 – 1970 were uniform in design and featured a very limited range of patterns, by the 1990's this repertoire had expanded dramatically and included a wide range of new patterns as well as innovative variations of traditional ones (Greenfield et al. 2000). The authors explain the proliferation of Zinacantec Maya designs over the last 20 years in relation to changing patterns of socialisation through which young weavers acquire their craft skills. In the period prior to and including 1969 – 1970, Greenfield et al. (2000) reported that craft learning was carried out under the constant supervision of members of the elder generation, who directly intervened to correct any errors made by the learner. The authors argue that this type of apprenticeship was oriented toward the specific goal of maintaining Zinacantan craft traditions, which constituted part of a broader set of traditional values: the *baz'i*, or 'true way' that governed a wide range of behaviours. However, by 1991 – 1993 the collaborative style learning observed previously had become far less prominent. Instead, learners acquired their skills more independently through trial-and-error, and were as likely to seek assistance from members of their own generation as their mothers or aunts when they required it. According to Greenfield et al. (2000), the changing methods of craft learning they document can be accounted for by a broader cultural shift in Zinacantan values: rather than emphasising the importance of 'tradition', they responded to social and economic change by encouraging individual innovation and experimentation to exploit new opportunities. In the specific case of their weavings, the rapid commercialisation of textile-production in the region promoted the introduction of new and original patterns. Greenfield et al. (2000) claim that this emphasis on novelty was incompatible with the goals of more traditional processes of craft transmission, and that "with the shift from a more interdependent to independent style of weaving apprenticeship, girls had the independence to be more creative in their weaving, going outside the traditional frameworks of what a woven piece of cloth should look like and innovating with new designs and colours…. As many families moved to a more commercial, money-based ecocultural pattern, socialisation processes changed to stimulate independent learning and innovation" (Greenfield et al. 2000:372).

The proliferation of new textile designs among the Zinacantec in Chiapas following the monetarisation of their economy and commercialisation of their weavings has clear resonances with recent developments in regions such as Chahar-Mahal-va-Bakhtiari in Iran. Unfortunately, a diachronic assessment of the impact of commercialisation in the latter case is not possible, due to the lack of direct evidence on how textile skills and designs were learned in the past. However, based on the discussion presented here, it seems likely that, rather than producing the sudden and qualitative shift in processes of craft transmission observed among the Zinacantec, the commercialisation of carpet production in Chahar-Mahal-va-Bakhtiari amplified processes of assimilation and innovation that already existed among communities in the region. Rather than developing in complete isolation, these groups' craft traditions are likely to have been influenced partly by direct contact, whereby males were able to provide some limited information on rug-production in other groups they visited, and more importantly, through indirect processes of horizontal cultural transmission facilitated by employment in *bibi* workshops and local textile markets that existed prior to the carpet boom. In contrast, weavers in Turkmen tribal communities are unlikely to have been exposed to sources of new designs prior to the Russian conquest of their territories in the late 19th century. The subsequent shift in processes of craft transmission suggested by phylogenetic analyses which included door-rugs (*ensi*) and other textiles (Tehrani & Collard 2001) produced in this period can probably be accounted for by the rapid commercialisation of Turkmen weaving: the popularity of antique Turkmen textiles acquired by western rug merchants following the pacification of the tribes stimulated the production of new carpets destined for export (Helfgott 1994; Thompson 1980; Spooner 1986). By the 1960s, Irons noted that the majority of carpets woven by Yomut women were produced for sale, rather than domestic use (Irons 1990). Consequently, craft traditions that had been maintained by conservative processes of cultural transmission similar to those observed among the Zinacantec in the recent past (Greenfield et al. 2000), in which weavers acquired their skills from elder female kin (Moshkova 1980; Ponomaryov 1980), became increasingly influenced by the pressures and opportunities presented by commercial production. As Spooner has remarked: "The Western interest in Turkmen carpets has had the effect of alienating the Turkmen from their own forms of artistic expression. Before, they worked with designs embodying symbols that were extensions of their social identity. Now these symbols have become the property of others. To repossess them, they must now find out from others what they mean" (Spooner 1986:230).

CHAPTER 10

Conclusions

10.1 Summary of the Case Study

This thesis has addressed recent debates regarding cultural evolution in relation to the long-standing anthropological problem of the origins and maintenance of cultural diversity among tribal populations in Iran. Linguistic evidence and ethnographic data provide conflicting accounts of the relative importance of descent from ancestral populations and interactions between contemporaneous groups in generating social and cultural entities in the region. These issues were investigated by testing how well four models of cultural diversification accounted for patterns of material culture variation among Iranian tribal populations. The two most contrasting models are represented by the 'phylogenesis hypothesis' and 'ethnogenesis hypothesis'. The former proposes that cultural diversification occurs through the bifurcation of ancestral populations into new ones and predicts that cultural, linguistic and genetic patterns are linked by a tree-like, branching pattern of descent. The latter hypothesis contends that cultural diversification occurs through borrowing and blending between contemporaneous social/ethnic groups, which frequently collapse, mix and merge. According to this model, cultural, linguistic and genetic patterns are only loosely connected to one another, and are unlikely to conform to a phylogenetic tree model.

In Chapter 3, the predictions of the phylogenesis and ethnogenesis hypotheses were tested through cladistic analyses of a dataset comprising 110 material culture traits sampled from nine Iranian tribal confederacies. Most of these traits related to textile crafts, such as pile-woven and flat-woven carpets, felt items, saddle-bags, animal trappings and tent fabrics. The results of the analyses indicated that both phylogenesis and ethnogenesis contributed to the evolution of the craft assemblages: According to the Consistency Index, just over half of the resemblances among the assemblages were consistent with a bifurcating tree structure, suggesting that they arose by descent from common ancestral assemblages. The remaining resemblances, on the other hand, seem to have arisen through either independent evolution, or borrowing and blending. The results of a bootstrap analysis returned varying levels of support for each of the clades represented in the craft tree, ranging between 53% and 100%. Further investigation into these hypotheses revealed that they were only partially consistent with patterns of linguistic diversity: Three of the five clades returned by the analyses comprised linguistically related populations, while the remaining two clades included both related and unrelated populations. Notably, linguistically related populations who were geographically distant from one another were not grouped together in the tree. On the other hand, it was also clear that geographical proximity was not a sufficient basis for determining relationships between the craft assemblages. Based on this initial assessment, it was concluded that processes of craft transmission were not entirely compatible with either the phylogenesis hypothesis or the ethnogenesis hypotheses, but involved a combination of both descent from ancestral populations and borrowing and blending between neighbouring groups.

The second group of analyses (Chapter 4) investigated whether the diversification of Iranian tribal craft assemblages could be more accurately accounted for by a third model - the 'core traditions' hypothesis. Ethnographic observations of craft learning suggested that processes of cultural transmission differed for technical skills and for designs. It was hypothesised that the division of craft traits into these categories roughly corresponded to the theoretical characterisation of 'core traditions' and 'peripheral traits'. Whereas the former are believed to be inherited from ancestral populations and evolve through branching processes, the latter are frequently acquired through borrowing and blending between neighbouring groups. Separate analyses of a technical traits dataset and decorative traits dataset offered limited support for this hypothesis: The cladogram obtained from the former had a higher CI (0.58) than that obtained from the original craft traits data, suggesting that resemblances between the groups' craft techniques were more consistent with a branching model of descent. Most of the phylogenetic hypotheses represented by the technical traits cladogram also enjoyed stronger bootstrap support (although the range of 55% - 99% was similar) and were more consistent with linguistic patterns than those returned by the first set of analyses. The cladogram obtained from the decorative traits data, on the other hand, had a lower CI (0.52) than both the technical traits cladogram and combined craft traits cladogram. Bootstrap support for the phylogenetic hypotheses represented in the decorative traits cladogram were also generally lower and less consistent with linguistic patterns. Nevertheless, these differences were less pronounced than would be expected by the 'core and periphery' hypothesis, since both sets of data contained evidence of branching and blending. Moreover, for the Turkic-speaking groups, decorative traits were actually more closely associated with linguistic affiliations than the technical traits were.

Consequently, it was reasoned that, rather than comprising a single cultural core, Iranian tribal material culture assemblages might include 'many coherent units' or 'multiple packages'. This fourth model of cultural diversification consists of two claims, which were investigated separately. Chapter 5 assessed the extent to which the craft assemblages were generated by multiple patterns of inheritance, including transmission between neighbouring groups and descent from ancestral populations. The linguistic and geographical distributions of resemblances between the assemblages indicated that, overall, approximately 30% of resemblances could be accounted for by descent alone (vertical transmission), 43% arose through a combination of descent and borrowings (vertical and horizontal transmission), with the remainder requiring hypotheses of independent invention. While these findings are consistent with the predictions of the model, a more detailed examination revealed that only three of the assemblages (the Bakhtiari, Boyer Ahmad and Qashqa'i) were strongly influenced by processes of vertical *and* horizontal transmission. The latter made a negligible contribution to three other assemblages (the Papi, Shahsevan and Talesh) and no contribution to the remaining two assemblages (the Tekke and Yomut), which appear to have evolved through descent alone. Therefore, only a minority of the assemblages from which data were sampled appear to have been generated by multiple patterns of inheritance.

The next chapter (6) concerned the second claim of the 'multiple packages' model, which proposes that many of the traits acquired by populations from different sources are associated with coherent and stable cultural traditions rather than representing independent units of transmission and reticulation. This claim was evaluated in relation to correlations among the linguistic and geographical distributions of resemblances among the assemblages and a qualitative assessment of how certain traits might be inter-linked. It was reasoned that traits that were consistently correlated among both related and unrelated groups and relate to the same material culture domain (e.g. tent-making, clothing or animal decoration) are likely to represent coherent craft traditions. However, relatively few of the correlations identified in this analysis fulfilled both criteria. With some notable exceptions, the majority of traits that were correlated among related groups (who are likely to have inherited them from a common ancestor) appear to have been selectively assimilated by neighbouring groups on an individual basis. Traits that were correlated among both related and unrelated groups, on the other hand, rarely suggested an intrinsic functional or symbolic inter-relationships. Most of these groupings cut across different material culture domains, and are therefore more likely to represent instances of parallel transmission (i.e. the selective assimilation of traits from the same source) rather than true packages. Therefore, it can be concluded that the Iranian tribal craft assemblages do not consist of 'multiple packages'.

The last three chapters (7 – 9) differed from preceding ones. Rather than investigating general models of cultural diversification in relation to the craft assemblages as a whole, these chapters focused on the evolution of a single craft tradition – Persian 'Garden Carpets' – among two groups, the Turkmen and Bakhtiari. Cladisitic analyses were carried out on Garden Carpet designs sampled from populations associated with both groups. The results of the analyses were interpreted in relation to the specific social and economic conditions that are likely to have influenced the transmission of these designs among both groups. Among the Turkmen, the Garden Carpet tradition is likely to have been originally acquired from an external, urban source and used to decorate their door rugs (*ensi*). However, according to the results of the analyses, the subsequent evolution of the tradition was not significantly influenced by horizontal transmission, since the relationships between the different groups' *ensi* designs can be largely accounted for by a phylogenetic, branching pattern of descent. Ethnographic and historical data suggests that several mechanisms might have restricted borrowing and blending between different Turkmen tribes. These include restrictions on the movement of women, endogamous marriage practises and, in particular, inter-tribal warfare.

These results contrast with those returned by cladistic analyses of the designs used on *kheshti* carpets made in the province of Chahar Mahal va Bakhtiari, which are believed to originate in the same tradition as *ensi* designs. Relationships between the carpets produced by populations in this region, which include Bakhtiari and sedentary groups, did not fit a bifurcating tree model very well. Whereas between 60% - 74% of resemblances between Turkmen *ensi* designs were consistent with the phylogenetic hypotheses returned by analyses of the data, only half of resemblances between *kheshti* designs fitted a bifurcating tree structure. Moreover, bootstrap analyses failed to generate any phylogenetic hypotheses regarding the relationships between different groups' *kheshti* designs. These results suggest that *kheshti* designs were widely circulated among populations in the Chahar Mahal va Bakhtiari. Several explanations for this are suggested by ethnographic and historical data. Firstly, unlike the Turkmen, warfare among the Bakhtiari was extremely uncommon, since different 'tribes' or descent groups were integrated into a single structure of political organisation and co-operation. Although contact between women belonging to different communities was probably infrequent, weavers are likely to have been particularly influenced by workshops managed by the wives of Bakhtiari *khans*. In the past, these workshops are likely to have introduced many novel and fashionable urban designs into the repertoires of many rural communities. However, in recent times, the adoption of unfamiliar patterns by weavers in camps and villages has probably been even more influenced by commercial production. One of the most important features of modern weaving is the use of 'cartoons' provided by urban-based merchants, which are widely distributed throughout the region. Furthermore, the dependence of many communities on cash generated from carpet sales is a strong incentive for weavers to experiment with new designs and imitate commercially successful ones. The impact of commercialisation is also evident in data-sets that included modern Turkmen weavings, suggesting that it is an increasingly important mechanism of cultural diffusion throughout the region.

10.2 General Conclusions

The main conclusion that can be drawn from this case study is that the processes responsible for generating Iranian tribal craft traditions vary from case to case, and cannot be accounted for by a single model. Descent from ancestral populations and branching processes were clearly more important in generating material culture variation than the ethnogenesis hypothesis predicted. However, only two of the assemblages - the Yomut and Tekke - appear to have originated through phylogenesis alone. With the exception of the Baluch, who were isolated from the other populations included in this study, all the other groups' craft traditions were heavily influenced by borrowing and blending, and therefore conflicted with the phylogenesis model. Subsequent investigations into the adoption of traits from neighbouring groups also revealed that the influence of these processes was less constrained and more varied than would have been expected by the 'core traditions' and 'multiple packages' models, both of which predicted a greater degree of coherence among certain types or groups of traits across the assemblages.

In fact, one of the most notable and surprising results of this case study was that the diversification of the material culture assemblages does not appear to have been significantly affected by any intrinsic constraints on craft transmission. For example, it has been argued that craft learning is likely to usually occur between members of the same kin/social group because the costs incurred by both teachers and learners restricts the transmission of traits between unrelated individuals and groups (e.g. Shennan and Steele 1999; Tehrani and Collard 2002). Thus, Tehrani and Collard (2002) suggested that the time and effort involved in learning new textile designs might have acted as a barrier to borrowing and blending between Turkmen populations, since weavers belonging to different groups are unlikely to have interacted with one another frequently. However, although similar constraints on the movement of women and endogamous marriage practises were also present among the other Iranian tribal populations studied here, they do not appear to have prevented cultural transmission between neighbouring groups. This suggests that either the costs of craft learning might not be as severe as previously assumed, or were balanced by the potential benefits of copying traits from other groups. For example, the Qashqa'i appear to have acquired the skills necessary to construct black goat hair tents from neighbouring groups because they are better suited to the ecology and climate of the Zagros region than the framed felt tents associated with other Turkic-speaking groups. It has also been suggested that the transmission of designs between groups (e.g. among populations in Chahar Mahal va Bakhtiari) is likely to be often associated with commercial craft production, whereby consumer demand provides a strong incentive for weavers to copy traits from other sources. This probably explains why Lor-speaking populations, particularly the Boyer Ahmad, adopted so many decorative traits from the Qashqa'i: Following the carpet boom in the last century, weavings attributed to the latter were renowned for their quality and beauty, and were especially popular among consumers in the West (Helfgott 1994).

These examples indicate, to varying degrees, weavers in these communities were discriminating and selective in adopting and discarding traits. Thus, processes such as indirect bias, in which learners copy a cluster of traits and transmit them to others as an integrated package or tradition, does not appear to have been as significant in the evolution of Iranian tribal craft traditions as it does in other studies of cultural transmission (e.g. Bettinger and Eerkens

1999). Nor do stable and long-lasting textile traditions appear to have maintained by other inherent constraints on craft transmission, such as the functional or symbolic inter-relationships among traits (e.g. Ortman 2000; Boyd et al. 1997; Petrequin and Petrequin 1999). These possibilities were considered in Chapters 4 – 6. Although there was some evidence that Persian-speaking groups are linked by a number of craft techniques inherited from a common ancestral population and that Turkic-speaking groups are associated with a shared design tradition, a large proportion of both groups of traits have either been discarded by some groups, or transmitted to unrelated, neighbouring populations on an individual basis. Traits that were consistently correlated among both related and unrelated populations, on the other hand, usually cut across material culture domains and did not appear to share any tangible functional or symbolic connections to one another.

Thus, it appears that the persistence or disintegration of Iranian tribal craft traditions depend more on *extrinsic* factors than on intrinsic constraints. A comparative study of the evolution of Garden Carpet designs among populations associated with the Turkmen and Bakhtiari confederacies suggested that the former varied between different populations and between different historical periods. The investigation suggested that broader sociological and economic contexts of craft production were particularly important in the diversification of Garden Carpet designs among both groups: During the 18th and 19th centuries, Turkmen populations were divided into endogamous descent groups that were frequently at war with one another. In these conditions, each group's craft traditions appear to have developed in relative isolation from external influences. In contrast, the Bakhtiari descent groups were integrated into larger, hierarchical political structures which provided specific institutional mechanisms for inter-group co-operation and for preventing or mediating disputes. Although ordinary weavers are unlikely to have been in direct contact with one another or to have moved between groups (due to restrictions on women travelling and endogamous marriage practices), employment in carpet workshops managed by the wives of tribal leaders, the *bibis*, provided them with a common source of new designs, many of which were urban in origin. In recent times, the monetarisation of rural economies in both Turkmen and Bakhtiari areas has led to the commercialisation of craft production. With the integration of rug-weaving communities into new and growing regional markets, rug merchants and their agents played an increasingly important role in the circulation of new designs, often providing weavers with 'cartoons' to copy patterns from directly.

The influence of forms of social and economic organisation on processes of craft transmission is also evident in other Iranian tribal material culture assemblages. Like the Bakhtiari confederacy, the Qashqa'i and Boyer Ahmad confederacies were also highly centralised and hierarchical, consisting of multiple layers of authority and affiliation. According to the results of the craft traits analyses, the craft assemblages of both groups were strongly influenced by horizontal transmission. Since *bibibaff* workshop production was also carried out in these confederacies (Helfgott 1994), it can be speculated that a number of new designs were introduced to tribal communities from this source. Although *bibi*s belonging to different confederacies are not likely to have interacted as frequently as those belonging to the same confederacy, many of their workshops would have employed designs from similar sources, such as urban and courtly carpets. Moreover, regional textile markets have existed in the south-western province of Fars (where the Qashqa'i and Boyer Ahmad winter camps are located) as long as those in Chahar Mahal va Bakhtiari, and preceded the 20th century carpet boom (Helfgott 1994; Baker 1994). This suggests that commercial production is likely to have been a long-standing influence on Bakhtiari, Boyer Ahmadi and Qashqa'i craft traditions. In contrast, borrowing and blending played a far less prominent role in generating the Talesh, Papi, Baluch and Shahsevan assemblages. The social organisation of the first three groups was far more de-centralised and segmentary than that of the Bakhtiari, Boyer Ahmad and Qashqa'i and lacked a permanent, hereditary class of leaders who might have established *bibi* workshops in these areas. Craft production among the Talesh, Papi and Baluch also appears to have been geared towards subsistence and personal use rather than consumer demand, and was relatively insulated from commercial pressures until recently (Bazin 1980; Mortensen & Nicolaisen 1993; Konieczny 1979; Helfgott 1994). Although the social organisation of the Shahsevan was more hierarchical, and shared a number of features with the western and south-western tribal confederacies, there is no record of workshop or commercial craft production among these communities prior to the carpet boom (e.g. Tapper 1979; Tanavoli 1985; Helfgott 1994).

In addition to these conclusions, it is worth reflecting on the highly productive combination of quantitative and qualitative research methods that has been used in this project. No previous study has attempted to integrate modern biological phylogenetic techniques to analyse cultural data with ethnographic fieldwork on cultural learning. This unique approach has yielded three insights that are likely to be particularly important to understanding processes of cultural diversification in Iran and elsewhere: Firstly, it should not be assumed that evidence of borrowing and blending in cultural data-sets can only be explained by direct interaction between members of neighbouring populations. Previously, it has been suggested that cultural exchanges between contemporaneous groups mainly result from contact, trade and inter-marriage (e.g. Terrell 1988, 2001; Terrell et al. 1997; Moore 1994, 2001). However, the influence of rug merchants and workshops in promoting the circulation of carpet designs in Chahar Mahal va Bakhtiari and elsewhere in Iran suggests that more theoretical attention should be given to the role of 'third parties' in mediating cultural exchanges between groups. Secondly, the extent to which processes of cultural inheritance are conservative (i.e. intra-group transmission or parent-to-offspring learning) or innovative (i.e. individual trial-and-error learning or inter-group transmission) does not necessarily depend on any intrinsic constraints associated with learning costs or the functional/symbolic coherence of an assemblage, core or package of traits. Instead, it is proposed here that, in many cases, processes of cultural transmission should be interpreted in relation to the specific incentives that determine which traits a population of social learners will choose to retain, discard or adopt from other groups. For example, commercial carpet production in Chahar Mahal va Bakhtiari appears to have had a strong influence on pile-weaving in the region, with many weavers copying or inventing new designs. On the other hand, commercial incentives have probably had little or no impact on the transmission of other traits, such as the skills required to construct tents or make packing bands. This hypothesis is supported by the fact that the analyses carried out in Chapters 3 – 6 suggested that although borrowing and blending made a significant contribution to the evolution of Bakhtiari craft traditions, these processes were less important than descent, particularly in respect to weaving techniques.

Lastly, in so far as micro-level processes of cultural learning are often connected to broader social and economic systems, as this thesis contends, macro-level processes of cultural diversification are unlikely to remain constant through time. This is best illustrated by the example of the Turkmen. In the 16th century, populations ancestral to the Yomut, Tekke, Ersari, Salor and Saryk were integrated into a large and powerful confederacy, which probably shared a number of common features with the Bakhtiari and Qashqa'i confederacies (Wood 1970; Barthold 1962). The emergence of these tribes as independent entities in the 18th century occurred following the collapse of this broad-based, hierarchical coalition. Although the evolution of these groups' craft traditions subsequent to this period has been mostly dominated by descent and branching processes, it is possible that borrowing and blending were more influential in earlier periods of Turkmen history than they are now, given that many Turkmen designs (including Garden Carpet *ensi* patterns) are believed to be urban in origin (e.g. Thompson 1980). Moreover, there is strong evidence that these processes are becoming increasingly important among the Turkmen following the loss of the tribes' political autonomy and their subsequent integration into a modern market economy (Tehrani and Collard 2002). Studies of Iranian tribal history suggest that the case of the Turkmen is far from unique: On the contrary, tribal populations in Iran have frequently formed alliances, grown into large confederacies and then separated again into smaller, more egalitarian entities (e.g. Tapper 1991; Beck 1991; Garthwaite 1983; Barthold 1962). Similar processes have been widely reported in the ethnographic record and are known in social anthropological literature as 'oscillating equilibrium' (e.g. Leach 1977). According to the findings of this case study, a likely corollary of these events is that the evolutionary histories of many cultural traditions probably consist of multiple phases of branching and blending, spreading in space and splitting in time as populations invent and re-invent their relationships to one another.

10.3 Prospects for Future Research

The following suggestions for future projects reflect both the limitations of this project and the issues raised by it. Firstly, further research is required into micro-level processes of craft transmission. Ethnographic data collected through fieldwork in south-western Iranian tribal communities provided some important insights into how craft skills and designs are learned from different sources, such as kin-members, workshops and 'cartoons' provided by rug merchants. These insights were used to interpret changing patterns of cultural diversification among the Turkmen, particularly with regard to the impact of commercialisation among the latter. A more direct assessment will require fieldwork among Turkmen communities in the frontier regions of Iran, Turkmenistan and Afghanistan. Unfortunately, this was not possible during the fieldwork phase of this project for reasons of personal safety and the restrictions imposed by government authorities on travel in the area during the post-9/11 war in Afghanistan and the influx of refugees into Iran at that time. In addition to this, the region was affected by severe flooding and an escalation in violent confrontations between border police and drug-traffickers.

The findings of this case study could also be elaborated upon through further ethnographic inquiries into the costs and benefits of craft learning among tribal populations in Iran. This would shed more light on the decision-making processes that determine whether weavers retain, discard or replace particular skills or designs, borrow from other groups or experiment with new techniques and styles. One particularly useful approach to these issues would be to investigate how these choices might vary from village to village, or even from family to family, depending on their relative involvement with the market, resources and available labour and time. Since this case study has concluded that processes of cultural transmission vary between different tribal populations, a more detailed examination of intra-tribal variation would be a logical means of investigating the issues raised in this project further.

Secondly, a better understanding of the relationship between cultural patterns and population histories would be greatly assisted by more accurately defined linguistic and genetic data. There are currently no published linguistic or genetic phylogenies for Bakhtiari and Turkmen tribes and sub-tribes with which to compare the cladograms returned by the analyses of their Garden Carpet designs (Chapters 8 & 9). Although there is ethnohistorical information on the Turkmen that is based on their oral traditions (Wood 1970; Barthold 1963), it is not believed to be a trustworthy source of information on the genesis and relationships of the tribes (Tehrani and Collard 2002). There has also been a genetic study of the Turkmen (Turaeva et al. 1985) which, although indicating that gene-flow between the tribes has been negligible, did not specify their relationships to one another. Identifying patterns of genetic and linguistic inheritance would be even more useful for assessing hypotheses regarding the origins and growth of the Bakhtiari, Papi, Boyer Ahmad and Qashqa'i confederacies. It would help establish whether the closer relationship of the Bakhtiari and Papi assemblages to one another than to the Boyer Ahmad assemblage might be explained by them sharing a common ancestor of more recent origin than the one from which all Lor-speaking groups are descended. Additionally, although the mainly Turkic-speaking Qashqa'i confederacy is known to have absorbed some Lor-speaking populations, this study has suggested that the resemblances between the Qashqa'i, Boyer Ahmad and Bakhtiari assemblages probably arose mostly through borrowing and blending, rather than intermarriage. This conclusion was based on the lack of any evidence suggesting that the Boyer Ahmad and Bakhtiari assimilated Turkic-speaking populations, although many of the traits they share with the Qashqa'i are likely to be Turkic in origin. However, this view would have to be revised if genetic data indicated that movement of individuals among groups had been more substantial than is currently thought.

In connection with these issues, it would also be interesting to investigate whether cultural exchanges between these groups also included linguistic and other behavioural traits. As Shennan (2000) has pointed out, it cannot be assumed that the forces that have influenced the diversification of material culture assemblages are the same as those that generated other socially-learned traditions. It is certainly possible – perhaps even likely – that the transmission, rates of change and coherence of languages, ritual practices, folk stories and subsistence skills associated with these groups differ from the craft traditions studied here. The former might be more subject to internal constraints or be even more influenced by external socio-economic pressures. So far, the relative importance of internal and external constraints on cultural transmission remains a largely unexplored problem. However, based on the conclusions of this case study, these issues are likely to be of crucial importance to understanding the origins and maintenance of cultural diversity in Iran and probably many other regions of the world.

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APPENDIX A

Iranian Tribal Craft Traits Data

Table A1. Inventory of Iranian tribal textile-related craft items

	Item	Tribal Group	Source
1	Felt tent	Yomut	Andrews 1997 **drawing a2**
2	Tent band	Yomut	Mackie & Thompson 1980 **plate 1**
3	Door cover	Yomut	Mackie & Thompson 1980 **plate 79**
4	Cane screens	Yomut	Andrews 1980 **drawing a2**
5	Felt carpet	Yomut	Andrews 1980 **figure 25**
6	Loom	Yomut	Irons 1980 **fig. 19**
7	Pile Carpet	Yomut	Mackie & Thompson 1980 **plate 67**
8	Pile Carpet	Yomut	Mackie & Thompson 1980 **plate 68**
9	Pile Carpet	Yomut	Mackie & Thompson 1980 **plate 69**
10	Camel trapping	Yomut	Mackie & Thompson 1980 **plate 75**
11	Saddle bag	Yomut	O'Bannon et al. 1990 **plate 20**
12	Storage bag	Yomut	Mackie & Thompson 1980 **plate 72**
13	Fur hat	Yomut	Irons 1980 **fig. 14**
14	Felt tent	Tekke	Andrews 1980 **pages 54-55**
15	Tent band	Tekke	Mackie & Thompson 1980 **plate 2**
16	Door cover	Tekke	Mackie & Thompson 1980 **plate 45**
17	Cane screens	Tekke	Andrews 1997 **drawing a2**
18	Pile Carpet	Tekke	Mackie & Thompson 1980 **plate 27**
19	Pile Carpet	Tekke	Mackie & Thompson 1980 **plate 28**
20	Pile Carpet	Tekke	Mackie & Thompson 1980 **plate 29**

21	Camel trapping	Tekke	Mackie & Thompson **plate 43**
22	Saddle bag	Tekke	O'Bannon et al. 1990 **plate 20**
23	Storage bag	Tekke	Mackie & Thompson **plate 38**
24	Fur hat	Tekke	Mackie & Thompson **plate 38**
25	Felt tent	Shahsevan	Andrews 1997 **drawing d17**
26	Door cover	Shahsevan	Andrews 1997 **drawing d17**
27	Tent band	Shahsevan	Tanavoli 1985 **plate 274**
28	Packing band	Shahsevan	Tanavoli 1985 **plate 284**
29	Corded rope	Shahsevan	Tanavoli 1985 **plate 143**
30	Coarse covering (*jajim*)	Shahsevan	Tanavoli 1985 **plate 37**
31	Flat-woven carpet	Shahsevan	Tanavoli 1985 **plate 5**
32	Flat-woven carpet	Shahsevan	Tanavoli 1985 **plate 12**
33	Flat-woven carpet	Shahsevan	Tanavoli 1985 **plate 25**
34	Saddle bag	Shahsevan	Tanavoli 1985 **plate 135**
35	Saddle bag	Shahsevan	Tanavoli 1985 **plate 169**
36	Storage bag	Shahsevan	Tanavoli 1985 **plate 51**
37	Storage bag	Shahsevan	Tanavoli 1985 **plate 48**
38	Salt bag	Shahsevan	Tanavoli 1985 **plate 251**
39	Horse trapping	Shahsevan	Tanavoli 1985 **plate 277**
40	Camel trapping	Shahsevan	Tanavoli 1985 **plate 279**
41	Tent	Talesh	Bazin 1980 **plate XL B**
42	Reed panels	Talesh	Bazin 1982 **fig. 47**
43	Basket	Talesh	Bazin 1980 **plate LXI A**
44	Felt carpet	Talesh	Bazin 1982:64; **Fig. 41**
45	Felt carpet	Talesh	Bazin 1980 **plate LXII A**

46	Flat woven carpet	Talesh	Bazin 1982 **page72**
47	Flat woven carpet	Talesh	Bazin 1980 **plate XLII A**
48	Coarse cover (*jajim*)	Talesh	Bazin 1982 **page72**
49	*Shal* (cotton fabric)	Talesh	Bazin 1982 **Fig. 45**
50	Horizontal loom	Talesh	Bazin 1982 **Fig. 26**
51	Vertical loom	Talesh	Bazin 1980 **plate LV B**
52	Animal skin container	Talesh	Bazin 1982 **fig. 26**
53	Tent	Baluch	Salzman 2000 **fig. 1.2-1.5**
54	Palm frond screens	Baluch	Salzman 2000 **page 24**
55	Palm frond baskets	Baluch	Salzman 2000 **page 396**
56	Corded wool	Baluch	Salzman 2000 **page 397**
57	Loom	Baluch	Konieczny 1979 **fig. 11**
58	Coarse cover (*jajim*)	Baluch	Konieczny 1979 **plate 2**
59	Flat woven carpet	Baluch	Konieczny 1979 **plate 4**
60	Flat woven carpet	Baluch	Konieczny 1979 **plate 5**
61	Flat woven carpet	Baluch	Konieczny 1979 **plate 8**
62	Storage bag	Baluch	Konieczny 1979 **plate 12**
63	Storage bag	Baluch	Konieczny 1979 **plate 19**
64	Saddle bag	Baluch	Konieczny 1979 **plate 27**
65	Saddle bag	Baluch	Konieczny 1979 **plate 28**
66	Salt bag	Baluch	Konieczny 1979 **plate 32**
67	Horse trapping	Baluch	Konieczny 1979 **plate 38**
68	Camel trapping	Baluch	Konieczny 1979 **plate 40**
69	Tent	Papi	Mortensen & Nicolaisen 1993 **plate 6**
70	Tent band	Papi	Mortensen & Nicolaisen 1993 **plate 6.102**

71	Corded wool rope	Papi	Mortensen & Nicolaisen 1993 **plate 6.100**
72	Rush mat	Papi	Mortensen & Nicolaisen 1993 **plate 6.28**
73	Packing band	Papi	Mortensen & Nicolaisen 1993 **plate 6.103**
74	Saddle bag	Papi	Mortensen & Nicolaisen 1993 **plate 6.111**
75	Saddle bag	Papi	Mortensen & Nicolaisen 1993 **plate 6.113**
76	Storage bag	Papi	Mortensen & Nicolaisen 1993 **plate 6.118**
77	Salt bag	Papi	Mortensen & Nicolaisen 1993 **plate 6.235**
78	Basket	Papi	Mortensen & Nicolaisen 1993 **plate 6.237**
79	Horizontal Loom	Papi	Mortensen & Nicolaisen 1993 **plate 6.300**
80	Vertical Loom	Papi	Mortensen & Nicolaisen 1993 **plate 6.303**
81	Coarse cover (*jajim*)	Papi	Mortensen & Nicolaisen 1993 **plate 6.207**
82	Felt carpet	Papi	Mortensen & Nicolaisen 1993 **plate 6.198**
83	Pile carpet	Papi	Mortensen & Nicolaisen 1993 **plate 6.197**
84	Pile carpet	Papi	Mortensen & Nicolaisen 1993 **plate 6.204**
85	Flat woven carpet	Papi	Mortensen & Nicolaisen 1993 **plate 6.206**
86	Shooting camoflauge	Papi	Mortensen & Nicolaisen 1993 **plate 6.164**
87	Animal skin container	Papi	Mortensen & Nicolaisen 1993 **plate 6.230**
88	Felt cap	Papi	Mortensen & Nicolaisen 1993 **plate 6.343**
89	Felt cloak	Papi	Mortensen & Nicolaisen 1993 **plate 6.354**
90	Wool cloak (*choogha*)	Papi	Mortensen & Nicolaisen 1993 **plate 6.344**
91	Tent	Boyer Ahmad	Fieldwork June 2001
92	Rush mat	Boyer Ahmad	Fieldwork June 2001
93	Tent band	Boyer Ahmad	Private collection, Yasuj, Iran
94	Packing band	Boyer Ahmad	Private collection, Yasuj, Iran
95	Corded wool rope	Boyer Ahmad	Fieldwork June 2001

96	Coarse cover (*jajim*)	Boyer Ahmad	Private collection, Yasuj, Iran
97	Saddle bag	Boyer Ahmad	Private collection, Yasuj, Iran
98	Storage bag	Boyer Ahmad	Private collection, Yasuj, Iran
99	Salt bag	Boyer Ahmad	Private collection, Yasuj, Iran
100	Long pile carpet (*gabbeh*)	Boyer Ahmad	Private collection, Yasuj, Iran
101	Pile carpet	Boyer Ahmad	Private collection, Yasuj, Iran
102	Pile carpet	Boyer Ahmad	Private collection, Yasuj, Iran
103	Pile carpet	Boyer Ahmad	Private collection, Yasuj, Iran
104	Flat woven carpet	Boyer Ahmad	Private collection, Yasuj, Iran
105	Flat woven carpet	Boyer Ahmad	Private collection, Yasuj, Iran
106	Shooting camoflauge	Boyer Ahmad	Private collection, Yasuj, Iran
107	Felt carpet	Boyer Ahmad	Friedl 2002:131
108	Felt cloak	Boyer Ahmad	Private collection, Yasuj, Iran
109	Felt cap	Boyer Ahmad	Fieldwork June 2001
110	Horse trapping	Boyer Ahmad	Private collection, Yasuj, Iran
111	Animal skin container	Boyer Ahmad	Fieldwork June 2001
112	Head band	Boyer Ahmad	Fieldwork June 2001
113	Tent	Bakhtiari	Digard 1981
114	Packing band	Bakhtiari	Willborg 2002 **plate 27**
115	Corded wool rope	Bakhtiari	Fieldwork April – July 2002
116	Coarse cover (*jajim*)	Bakhtiari	Willborg 2002 **plate 6**
117	Saddle bag	Bakhtiari	Willborg 2002 **plate 15**
118	Saddle bag	Bakhtiari	Willborg 2002 **plate 18**
119	Storage bag	Bakhtiari	Willborg 2002 **plate 20**
120	Storage bag	Bakhtiari	Willborg 2002 **plate 21**

121	Salt bag	Bakhtiari	Willborg (Stockholm exhibition Dec 2002)
122	Long pile carpet (*khersak*)	Bakhtiari	Willborg 2002 **plate 7**
123	Pile carpet	Bakhtiari	Willborg 2002 **plate 42**
124	Pile carpet	Bakhtiari	Willborg 2002 **plate 12**
125	Pile carpet	Bakhtiari	Willborg 2002 **plate 10**
126	Felt carpet	Bakhtiari	Willborg (Stockholm exhibition Dec 2002)
127	Flat woven carpet	Bakhtiari	Willborg 2002 **plate**
128	Flat woven carpet	Bakhtiari	Willborg 2002 **plate 8**
129	Coarse blanket (*djidjim*)	Bakhtiari	Willborg 2002 **plate 6**
130	Horizontal loom	Bakhtiari	Fieldwork April – July 2002
131	Vertical loom	Bakhtiari	Fieldwork April – July 2002
132	Shooting camoflauge	Bakhtiari	Fieldwork April – July 2002
133	Felt cloak	Bakhtiari	Digard 1981 **fig. 167**
134	Wool cloak (*choogha*)	Bakhtiari	Digard 1981 **fig 167**
135	Felt cap	Bakhtiari	Digard 1981 **fig. 4-5**
136	Head band	Bakhtiari	Digard 1981 **fig. 179**
137	Horse trapping	Bakhtiari	Willborg (Stockholm exhibition Dec 2002)
138	Tent	Qashqa'i	Allgrove 1976 **Item A2**
139	Cane screen	Qashqa'i	Allgrove 1976 **Item A5**
140	Corded wool rope	Qashqa'i	Allgrove 1976 **Item A9**
141	Tent band	Qashqa'i	Opie 1992 **plate 10.22**
142	Loom	Qashqa'i	Allgrove 1976 **Item E12**
143	Storage bag	Qashqa'i	Allgrove 1976 **Item A28**
144	Saddle bag	Qashqa'i	Allgrove 1976 **Item G46**

145	Salt bag	Qashqa'i	Allgrove 1976 **Item G33**
146	Pile carpet	Qashqa'i	Allgrove 1976 **Item H12**
147	Pile carpet	Qashqa'i	Parham 1996 **plate 1**
148	Pile carpet	Qashqa'i	Parham 1996 **plate 23**
149	Long pile carpet (*gabbeh*)	Qashqa'i	Parham 1996 **plate 96**
150	Flat woven carpet	Qashqa'i	Allgrove 1976 **Item**
151	Flat woven carpet	Qashqa'i	Parham 1996 **plate 108**
152	Coarse blanket (*jajim*)	Qashqa'i	Opie 1992 **plate 10.21**
153	Horse trapping	Qashqa'i	Allgrove 1976 **Item G45**
154	Camel trapping	Qashqa'i	Allgrove 1976 **Item G49**
155	Felt cap	Qashqa'i	Allgrove 1976 **Item B1**
156	Felt cloak	Qashqa'i	Allgrove 1976 **Item B61**
157	Head band	Qashqa'i	Allgrove 1976 **Item B2**
158	Basket	Qashqa'i	Allgrove 1976 **Item I11**
159	Tent	Arab Bedouin	Weir 1976 **plate 2**
160	Tent divide	Arab Bedouin	Weir 1976 **plate 43**
161	Reed screen	Arab Bedouin	Weir 1976 **plate 6**
162	Packing band	Arab Bedouin	Weir 1976 **plate 24**
163	Saddle bag	Arab Bedouin	Weir 1976 **plate 30**
164	Storage bag	Arab Bedouin	Weir 1976 **plate 46**
165	Loom	Arab Bedouin	Weir 1976 **plate 40**
166	Flat woven carpet	Arab Bedouin	Weir 1976 **plate 47**
167	Animal skin container	Arab Bedouin	Weir 1976 **photo IV**
168	Camel trapping	Arab Bedouin	Weir 1976 **plate 32**

Table A2. Description of Craft Traits Characters

	Character	Description	States	Distribution
1	Spun goat hair	Goat hair fibres are spun for use as yarn in tent canopy, selvages and binding string.	0 = absent 1 = present	Bedouin 1;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
2	Woven goat hair	Spun goat hair, plain-woven into panels that are sewn together for use as tent canopy.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
3	Plaited goat hair	Yarns of spun goat hair are twined and knotted into plaits for use as nets, bags and animal decoration.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
4	Spun wool	Wool fibres are spun using a spinner Z2S for use as yarn in carpets, bags, rush mats etc.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
5	Spun cotton	Cotton procured from town markets spun for use in carpet foundations and other materials.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 1; Talesh 1; Baluch 0
6	Corded wool	Spun wool corded to make ropes for use in saddle-bags, guy-ropes, etc.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
7	Plaited wool	Spun wool plaited for decorative purposes or use as netting in bags and animal trappings.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 1; Bakhtiari 0; Talesh 0; Baluch 1; Bedouin 1

8	Plaited palm frond leaves	Palm fronds are twisted together to create guy ropes.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
9	Rush mats	Panels of reeds or cane interwoven with undyed yarn in a striped or criss-crossing pattern.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 0; Talesh 1; Baluch 1
10	Straw mat	Large, open-weave floor covering woven from palm fronds.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 1; Baluch 1
11	Palm frond screens	Palm fronds interwoven to create a screen. Used by Baluchi in place of rush mats.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
12	Felt tent	Roof and walls of the tent made by professional felters and fitted to the tent frame.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
13	Felt carpet	Thick felt floor covering, usually decorated with simple patterns.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 1; Baluch 0
14	Horizontal ground loom	Loom laid flat on the ground. Warp threads are streched over the frame and controlled by a shed stick and heddle rod.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1.
15	Horizontal ground loom with a tripod supporting the heddle apparatus	A tripod is fixed above the loom and attached to the heddle rod.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0;

				Talesh 1; Baluch 1
16	Vertical loom	The vertical loom is a more complex apparatus and less portable, but more stable.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
17	Wool pile carpet	Spun dyed wool pile knotted onto warp threads, secured by wefts between each row of knots.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 0; Baluch 0
18	Rough pile rug (*gabbeh*)	Small rug with long-cut pile and scantily designs.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 0; Baluch 0
19	Pile carpet knots 1	Asymmetrical knots looped around one warp thread and passing under another warp thread.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0;; Talesh 0; Baluch 0
20	Pile carpet knots 2	Symmetrical knot looped around two warp threads.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;; Talesh 0; Baluch 0
21	Warp depression	In pile-woven carpets the tension of the weft determines the levels of alternate warps which, when they differ, are described as depressed.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 1; Shahsevan 0; Qashqai 1, 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Bakhtiari 0
22	2 Weft shots	The number of weft threads that secure each row of pile knots tied to the warp.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi

				Lor 1; Bakhtiari 1;Talesh 0; Baluch 0
23	Weft-faced flat-weaving	Instead of using pile, flat-woven textiles are patterned by dyed weft yarns woven onto the warp.	0 = absent 1 = present	Bedouin 1; Yomut ?; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
24	Shared warp technique.	Wefts of different colours share the same warp thread, reversing the direction of the weave to produce colourful patterns.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
25	Slit-tapestry technique	Wefts of different colours do not share warp threads, creating gaps in the design of the carpet.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
26	Extra-weft wrapping	Supplementary wefts are woven onto the foundation to provide additional patterns.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad 1; Papi Lor 1; Bakhtiari 1; Baluch 1
27	Extra-weft pile wrapping	Pile knots inserted into plain-weave foundation for decorative effect.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 1; Baluch 0
28	*Soumak* weft-wrapping	Weft yarns wrapped around pairs of warp threads, and then reversed to create multi-coloured patterns.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 0; Baluch 0

29	Warp faced flat-weaving	Dyed warp threads are twined together and secured by weft shots that are concealed behind the resulting warp patterns. Such textiles are used as animal covers (*jol*), furniture covers and blankets.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 0
30	Selvages using overcast threads	The edges of the carpet are secured by use of an additional stitching.		Bedouin 1; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh ?; Baluch0
31	Selvages using goat hair.	Edges of the carpet are secured using woollen yarns and goat hair.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh ?; Baluch 1
32	Selvages using double weft-cording.	The selvages feature wool of two colours corded together for decorative effect.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0.
33	End-finishes using plain-weave.	The ends of the carpet feature only the foundation plus a warp fringe.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
34	End-finishes using weft-float brocading.	Additional designs, usually simple, woven into the foundation in two or more colours.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
35	Tablet-woven bands	Plain-weave bands made by winding woollen yarns through perforated cards. Used as tent-bands or packing bands.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0

36	Tablet-woven bands with extra weft-wrapping	Additional designs, usually simple, woven into the foundation in two or more colours.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0;Talesh 0; Baluch 0
37	Tent surround	Double-corded wool, adorned with multi-coloured tassles.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
38	Door Cover	Square rug or felt used to seal the door-opening of the tent.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
39	Pile-woven Door Cover (*ensi*)	Pile-woven rug used as a door cover in felt tents.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
40	Goatskin container (*mashk*)	Tanned goatskin container with opening at anus sewn up. Used for many purposes from churning to holding water.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Kurd 1; Talesh 1; Baluch 1
41	Salt bag (*namakdan*)	Small bottle-shaped bag woven with rough pile or flat-weave.	0 = absent 1 = flat weave 2 = pile weave	Bedouin 1; Yomut 2; Tekke 2; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 2; Bakhtiari 1; Talesh 0; Baluch 1
42	Basketry	Simple oval basket made with bundle-coil technique.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 1; Baluch 1

43	Horse trapping	Decorative plain-woven band decorated with tassled ends.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 0; Baluch 0
44	Camel trapping	Large woven trapping with long colourful tassles.	0 = absent 1 = present	Bedouin 1; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
45	Pile-woven saddle bag	Large pile-woven saddle bag face with plain-weave back.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
46	Flat-woven saddle bag	Large plain-woven saddle bag with sumac weft-wrapping designs. The Bakhtiari bag features small areas of pile.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh ?; Baluch 1
47	Pile-woven storage bag	Such bags are usually placed at the end of the tent and covered with a *jajim* or its equivalent and used to transport goods on migration.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
48	Flat-woven storage bag	Weft-faced flat-woven bags come in different sizes and are decorated with soumak or weft floats.	0 = absent 1 = present	Bedouin 1; Yomut 0; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1.
49	Shooting Camoflauge	Large cloth decorated with simple animal designs used to conceal a hunter. A small opening is used for the gun barrell.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0

50	Felt cap	Cylindrical black or grey cap worn by men.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
51	Fur hat	Large fur hat worn by men.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
52	Head band	Women's head band, decorated with sequins and fitted under the chin with a pin.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 0; Baluch 0
53	Felt cloak	Sleeveless felt cloak worn by shepherds in winter.	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1;Talesh 0; Baluch 0
54	*Shal* clothing	A coarse, partially felted textile used in the Talesh region.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 1; Baluch 0
55	Plain-weave cloak (*chooga*)	Sleeveless plain-weave cloak with black and white "piano" design.	0 = absent 1 = present	Bedouin 0; Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
56	Border-field lay-out	Central field on carpets surrounded by multiple borders of varying width	0 = absent 1 = present	Bedouin 0; Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1

57	Repeating ornament pattern	The design of the carpet is organised by the repetition of a single ornament set against a plain field.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
58	"Brick" patterns (kheshti)	The field of the carpet is divided into separate compartments, each containing motifs.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
59	Medallion patterns	Large medallions in the field of the carpet provide a focus for the patterning of motifs.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
60	Row patterns	Motifs are organised into rows running across the width of the textile.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 0; Talesh 1; Baluch 0
61	"All-over" patterns	Geometric shapes are connected across the entire field of the textile.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 0; Talesh 1; Baluch 0
62	Diamond shapes	Commonly used to decorate carpet and bag fields.	0 = absent 1 = present	Bedouin 1;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
63	Diamond with stepped edges	Progressive steps run along the outside edges of the diamond.	0 = absent 1 = present	Bedouin 1;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh ; Baluch 1
64	Diamond with squared teeth edges	The outside of the diamond features square teeth running along the edges.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0

65	Diamond "goat horn" extensions	T-shaped arms extend from the diamond	0 = absent 1 = present	Bedouin 1;Yomut 0; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 1; Talesh 1; Baluch 1
66	Cross diamonds	Diamond with arms extending from each point to form a cross.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
67	Diamond medallions	A series of large diamond ornaments linked together along the centre of the field	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
68	All-over diamonds	Geometric diamond pattern decorating the field.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 1; Baluch 0
69	Diamond border	Series of interlocking diamonds used to decorate the border of a carpet.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 1; Talesh 1; Baluch 1
70	Goat horn shapes	"M"-shaped minor motif	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
71	Goat horn border	Goat horn motif repeated in a border to form a continuous pattern.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
72	Reciprocal patterned goat horn border	A series of goat horn and rosette motifs in a multi-coloured, reciprocal pattern.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0

73	Goat horn crosses	Cross shaped goat horn motif combining 4 sets of horns	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
74	Tipped goat horn cross	Cross motif tipped to form a diamond shape.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
75	Arrow-cross ornament	Square ornament with 4 arms, each with a split arrow-head tip.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor1; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
76	8-point star	Minor motif of a geometric 8-pointed star.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 0
77	8-point star version 1	Square heart in the centre of the star.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
78	8-point star version 2	Diamond heart in the centre of the star	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 1; Baluch 0
79	Z/S borders	Repetitive interlocking motif running along the border of a textile.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 1
80	Simple Z border	The shape of the motif resembles a "Z"	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1

81	Simple S border	The shape of the motif resembles a "S"	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
82	Bird S-borders	Interlocking bird motif in an S-shape	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
83	Curled leaf S-border	A serrated S-shaped motif repeated throughout the border	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
84	Wave border	A motif resembling the profile of a breaking wave repeated throughout the border	0 = absent 1 = present	Bedouin 1;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 1
85	Single crest waves	The motif consists of a single tooth or crest.	0 = absent 1 = present	Bedouin 1;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 1
86	Double crest waves	The motif consists of two teeth or crests.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 1; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
87	Reciprocal waves	The motif is patterened in a reciprocal manner in two or more colours.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
88	Non-reciprocal waves	The motif is patterened over a plain background.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 1

89	Reciprocal "bulb" border	A border design of reciprocal rounded shapes with stems.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
90	Reciprocal "C" border (barmak)	Geometric C-shaped motif repeated in two colours throughout a border.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
91	Tulip designs	Long stem with characteristic tulip flowers.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 1
92	Rosette motifs	Aerial view of rosette used as a minor motif to decorate fields and borders.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
93	Rosette version 1	Rosette featuring 4 flat petals.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
94	Rosette version 2	Four sets of petals curl out from the centre of the rose.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
95	Serrated comb	Symmetrical shape featuring teeth on both sides running lengthways.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 1
96	Straight combs	Combs are oriented vertically or horizontally.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0

97	Angled combs	Oblique angle.	0 = absent 1 = present	Bedouin ;Yomut 1; Tekke ; Shahsevan ; Qashqai 1; Boyer Ahmad Lor ; Papi Lor ; Bakhtiari ; Talesh ; Baluch
98	Teeth border	Simple border consiting of reciprocal teeth.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 0
99	Animal shapes	Simple, stylised animal shapes used to decorate the field and/or border.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 1
100	Animal head shapes	Animal head shapes are used on borders and on larger ornaments.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 0
101	Animal head border	Animal head border conceived in the form of the wave border.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
102	Animal head gul	Major ornament with animal heads running along the edges and an animal head extension at the top and bottom points.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 1; Baluch 1
103	Animal head trees	Series of motifs linked by animal head trees.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
104	Animal head replaced by arrows	The ornamental animal head is replaced by an arrow or bulb shape.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 0; Talesh 0; Baluch 1

105	Animal heads replaced by hooks (memling)	Animal heads along the sides are replaced by simpler hooked forms.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
106	4-leg ornament	Large ornament usually used in medallion with four hooked legs extending from the sides.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 1; Qashqai 1; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
107	Boteh	Paisley motif, representing cypress tree.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke 0; Shahsevan 0; Qashqai 1; Boyer Ahmad Lor 1; Papi Lor 0; Bakhtiari 1; Talesh 0; Baluch 0
108	"Infinity" motif	Coiled design in a complex figure of eight formation.	0 = absent 1 = present	Bedouin 0;Yomut 0; Tekke0; Shahsevan 0; Qashqai 0; Boyer Ahmad Lor 1; Papi Lor 1; Bakhtiari 1; Talesh 0; Baluch 0
109	Octagonal gul	Large ornament in shape of an octagon with motifs in the interior.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0
110	Lobed gul	Large ornament in shape of an octagon with rounded edges with motifs in the interior.	0 = absent 1 = present	Bedouin 0;Yomut 1; Tekke 1; Shahsevan 1; Qashqai 0; Boyer Ahmad Lor 0; Papi Lor 0; Bakhtiari 0; Talesh 0; Baluch 0

Table A3. Data Matrix for Craft Trait Characters

Taxa	Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Bedouin	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0
2	Yomut	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0
3	Tekke	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0
4	Shahsevan	0	0	0	1	0	1	1	0	1	0	0	1	1	1	0	1	0	0
5	Qashqai	1	1	0	1	1	1	1	0	1	1	0	0	1	1	0	1	1	1
6	BA Lor	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	1	1
7	Papi Lor	1	1	0	1	0	1	1	0	1	0	0	0	1	1	0	1	1	1
8	Bakhtiari	1	1	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1
9	Talesh	1	1	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0
10	Baluch	1	1	1	1	0	1	1	1	0	1	1	0	0	1	1	0	0	0

Taxa	Characters	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Bedouin	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0	0
2	Yomut	0	1	0	1	1	0	0	1	0	0	?	0	0	1	1	1	?	0
3	Tekke	1	0	1	1	1	0	0	1	1	0	?	0	0	1	1	1	1	1
4	Shahsevan	0	0	0	0	1	0	1	1	0	1	1	0	0	1	1	1	1	1
5	Qashqai	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1
6	BA Lor	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	0	1	0
7	Papi Lor	0	1	0	1	1	0	0	1	0	1	1	1	1	0	1	0	1	0
8	Bakhtiari	0	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	1	0
9	Talesh	0	0	0	0	1	0	0	1	0	0	1	?	?	0	1	0	0	0
10	Baluch	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	1	0	0

Taxa	Characters	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
1	Bedouin	0	0	0	1	1	0	1	1	0	1	0	1	0	0	0	0	0	0
2	Yomut	0	1	1	1	2	0	0	1	1	1	1	0	0	0	1	0	1	0
3	Tekke	0	1	1	1	2	0	0	1	1	1	1	1	0	0	1	0	1	0
4	Shahsevan	0	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	1	0
5	Qashqai	1	0	0	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0
6	BA Lor	1	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0
7	Papi Lor	1	0	0	1	2	1	1	0	0	1	0	1	1	1	0	1	1	0
8	Bakhtiari	1	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0
9	Talesh	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1
10	Baluch	0	0	0	1	1	1	0	1	0	1	0	1	0	0	0	0	0	0

Taxa	Characters	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
1	Bedouin	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
2	Yomut	0	1	1	1	0	0	0	1	1	0	0	1	0	0	0	1	1	1
3	Tekke	0	1	1	1	0	0	0	1	1	0	1	1	0	0	0	1	1	1
4	Shahsevan	0	1	0	0	0	1	1	1	1	1	0	0	0	0	0	1	1	0
5	Qashqai	0	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0
6	BA Lor	0	1	0	0	1	1	1	1	1	0	0	1	1	1	0	0	0	0
7	Papi Lor	1	1	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0
8	Bakhtiari	1	1	0	1	1	0	0	1	1	0	1	0	1	0	1	0	0	0
9	Talesh	0	1	0	0	0	1	1	1	1	0	1	0	0	1	1	0	0	0
10	Baluch	0	1	0	0	0	0	0	1	1	0	1	1	0	0	1	1	1	0

Taxa	Characters	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
1	Bedouin	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
2	Yomut	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	0	0
3	Tekke	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0
4	Shahsevan	1	0	0	1	1	1	1	0	1	0	0	1	1	0	1	0	1
5	Qashqai	1	0	1	1	1	1	1	0	1	0	0	1	1	0	1	0	1
6	BA Lor	0	0	1	1	1	1	1	0	1	0	0	1	1	0	1	0	1
7	Papi Lor	0	0	0	1	1	0	1	0	0	0	0	1	1	0	0	1	0
8	Bakhtiari	0	0	1	1	1	0	1	0	0	0	0	1	1	0	0	1	0
9	Talesh	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
10	Baluch	1	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0

Taxa	Characters	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106
1	Bedouin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Yomut	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	0
3	Tekke	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
4	Shahsevan	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1
5	Qashqai	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1
6	BA Lor	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	0
7	Papi Lor	1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0
8	Bakhtiari	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	1	0
9	Talesh	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
10	Baluch	0	1	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0

Taxa	Characters	107	108	109	110
1	Bedouin	0	0	0	0
2	Yomut	0	0	1	1
3	Tekke	0	0	1	1
4	Shahsevan	0	0	1	1
5	Qashqai	1	0	0	0
6	BA Lor	1	1	0	0
7	Papi Lor	0	1	0	0
8	Bakhtiari	1	1	0	0
9	Talesh	0	0	0	0
10	Baluch	0	0	0	0

Table A4. Data Matrix for Technical Traits Characters (Traits 1 – 55 in Table A2)

Taxa	Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Bedouin	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0
2	Yomut	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0
3	Tekke	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0
4	Shahsevan	0	0	0	1	0	1	1	0	1	0	0	1	1	1	0	1	0	0
5	Qashqai	1	1	0	1	1	1	1	0	1	1	0	0	1	1	0	1	1	1
6	BA Lor	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	1	1
7	Papi Lor	1	1	0	1	0	1	1	0	1	0	0	0	1	1	0	1	1	1
8	Bakhtiari	1	1	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1
9	Talesh	1	1	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0
10	Baluch	1	1	1	1	0	1	1	1	0	1	1	0	0	1	1	0	0	0

Taxa	Characters	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Bedouin	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0	0
2	Yomut	0	1	0	1	1	0	0	1	0	0	?	0	0	1	1	1	?	0
3	Tekke	1	0	1	1	1	0	0	1	1	0	?	0	0	1	1	1	1	1
4	Shahsevan	0	0	0	0	1	0	1	1	0	1	1	0	0	1	1	1	1	1
5	Qashqai	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1
6	BA Lor	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	0	1	0
7	Papi Lor	0	1	0	1	1	0	0	1	0	1	1	1	1	0	1	0	1	0
8	Bakhtiari	0	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	1	0
9	Talesh	0	0	0	0	1	0	0	1	0	0	1	?	?	0	1	0	0	0
10	Baluch	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	1	0	0

Taxa	Characters	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1	Bedouin	0	0	0	1	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0
2	Yomut	0	1	1	1	2	0	0	1	1	1	1	0	0	0	1	0	1	0	0
3	Tekke	0	1	1	1	2	0	0	1	1	1	1	1	0	0	1	0	1	0	0
4	Shahsevan	0	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	1	0	0
5	Qashqai	1	0	0	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	0
6	BA Lor	1	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0	0
7	Papi Lor	1	0	0	1	2	1	1	0	0	1	0	1	1	1	0	1	1	0	1
8	Bakhtiari	1	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0	1
9	Talesh	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0
10	Baluch	0	0	0	1	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0

Table A5. Data Matrix for Decorative Traits Characters (Traits 56-110 in Table A2)

Taxa	Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Bedouin	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
2	Yomut	1	1	1	0	0	0	1	1	0	0	1	0	0	0	1	1	1
3	Tekke	1	1	1	0	0	0	1	1	0	1	1	0	0	0	1	1	1
4	Shahsevan	1	0	0	0	1	1	1	1	1	0	0	0	0	0	1	1	0
5	Qashqai	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0
6	BA Lor	1	0	0	1	1	1	1	1	0	0	1	1	1	0	0	0	0
7	Papi Lor	1	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0
8	Bakhtiari	1	0	1	1	0	0	1	1	0	1	0	1	0	1	0	0	0
9	Talesh	1	0	0	0	1	1	1	1	0	1	0	0	1	1	0	0	0
10	Baluch	1	0	0	0	0	0	1	1	0	1	1	0	0	1	1	1	0

Taxa	Characters	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	Bedouin	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
2	Yomut	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	0	0
3	Tekke	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0
4	Shahsevan	1	0	0	1	1	1	1	0	1	0	0	1	1	0	1	0	1
5	Qashqai	1	0	1	1	1	1	1	0	1	0	0	1	1	0	1	0	1
6	BA Lor	0	0	1	1	1	1	1	0	1	0	0	1	1	0	1	0	1
7	Papi Lor	0	0	0	1	1	0	1	0	0	0	0	1	1	0	0	1	0
8	Bakhtiari	0	0	1	1	1	0	1	0	0	0	0	1	1	0	0	1	0
9	Talesh	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
10	Baluch	1	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0

Taxa	Characters	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1	Bedouin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Yomut	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	0
3	Tekke	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
4	Shahsevan	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1
5	Qashqai	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1
6	BA Lor	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	0
7	Papi Lor	1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0
8	Bakhtiari	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	1	0
9	Talesh	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
10	Baluch	0	1	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0

Taxa	Characters	52	53	54	55
1	Bedouin	0	0	0	0
2	Yomut	0	0	1	1
3	Tekke	0	0	1	1
4	Shahsevan	0	0	1	1
5	Qashqai	1	0	0	0
6	BA Lor	1	1	0	0
7	Papi Lor	0	1	0	0
8	Bakhtiari	1	1	0	0
9	Talesh	0	0	0	0
10	Baluch	0	0	0	0

APPENDIX B

Turkmen *Ensi* Designs Data

Table B1. Sample of Turkmen *ensi.*

	Item	Turkmen Group	Source
1	*Ensi* door cover	Yomut	Mackie & Thompson 1980 **plate 78**
2	*Ensi* door cover	Yomut	Mackie & Thompson 1980 **plate 79**
3	*Ensi* door cover	Yomut	Tzavera 1985 **plate 71**
4	*Ensi* door cover	Yomut	Tzavera 1985 **plate 72**
5	*Ensi* door cover	Yomut	Tzavera 1985 **plate 73**
6	*Ensi* door cover	Yomut	Victoria & Albert Museum **item 1050-1883**
7	*Ensi* door cover	Yomut	Azadi 1980 **plate 16**
8	*Ensi* door cover	Tekke	Mackie & Thompson 1980 **plate 45**
9	*Ensi* door cover	Tekke	Tzavera 1985 **plate 34**
10	*Ensi* door cover	Tekke	Victoria & Albert Museum **item T192-1922**
11	*Ensi* door cover	Tekke	Loges 1980 **plate 4**
12	*Ensi* door cover	Tekke	Loges 1980 **plate 5**
13	*Ensi* door cover	Tekke	Hoffmeister 1980 **plate 20**
14	*Ensi* door cover	Tekke	Gombos 1978 **page 346**
15	*Ensi* door cover	Saryk	Mackie & Thompson 1980 **plate 24**
16	*Ensi* door cover	Saryk	Tzavera 1985 **plate 16**
17	*Ensi* door cover	Saryk	Tzavera 1985 **plate 17**
18	*Ensi* door cover	Saryk	Tzavera 1985 **plate 18**
19	*Ensi* door cover	Saryk	Victoria & Albert Museum **item T191**
20	*Ensi* door cover	Saryk	Loges 1980 **plate 26**

21	*Ensi* door cover	Saryk	Loges 1980 **plate 27**
22	*Ensi* door cover	Ersari	Mackie & Thompson 1980 **plate 91**
23	*Ensi* door cover	Ersari	Tzavera 1985 **plate 102**
24	*Ensi* door cover	Ersari	Victoria & Albert Museum **item T95**
25	*Ensi* door cover	Ersari	Konig 1983 **plate 3**
26	*Ensi* door cover	Ersari	Konig 1983 **plate 4**
27	*Ensi* door cover	Ersari	Konig 1983 **plate 5**
28	*Ensi* door cover	Ersari	Konig 1983 **plate 6**
29	*Ensi* door cover	Salor	Pinner 1991 **plate 2**
30	*Ensi* door cover	Salor	Pinner 1991 **plate 3**
31	*Ensi* door cover	Salor	Pinner 1991 **plate 10**
32	*Ensi* door cover	Salor	Pinner 1991 **plate 11**
33	*Ensi* door cover	Salor	Pinner 1991 **plate 15**
34	*Ensi* door cover	Salor	Pinner 2004 **plate 4**
35	*Ensi* door cover	Salor	Tzavera 1984 **plate 20**

Table B2. Ensi trait descriptions

	Character	Description	States	Distribution
1	Quartered field	The central field comprises four compartments separated by channels.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 1
2	Bordered compartments	A black line border encloses each compartment	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 0.
3	Field decorated with *kush*	So-called "animal tree" design, featuring stylised animal heads connected to branches.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 1
4	*Kush* animal heads facing forwards	Two goat-like horns are visible on the animal heads, which are facing the direction of the viewer	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 1
5	*Kush* animal heads inclined	The animal heads are facing forwards, but appear to be inclined at an angle	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 0; Saryk 1
6	*Kush* animal heads in profile	The animal heads are facing one another.	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 1; Ersari 1; Saryk 0
7	*Kush* branches lattice	The branches of the animal head tree are curved and worked in a lattice.	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 1; Ersari 1; Saryk 0
8	*Kush* branches intersect	The lattice is worked in a "bush-like" pattern, rather than branches.	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 1; Saryk 0
9	Field decorated with "bird" motifs"	Small bird-like designs ordered in displaced rows.	0 = absent 1 = present	Yomut 1; Tekke 0; Salor 0; Ersari 0; Saryk 0
10	Field compartments include "boats".	Each of the compartments features a boat-shaped ornament lining the central channel which separates them.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 0.
11	Central channell	A central channell separates the top two compartments from the bottom two and decorated with repeating ornaments	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 0.

12	Central channell decorated with S-shaped patterns	Scrolling patterns in an S-shape	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 0; Saryk 0
13	Central channell decorated with "curled leaf"	A scrolling, jagged design commonly used on borders of *ensi* and other Turkmen carpets.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 0
14	Central channell decorated with "split-S" motif	A pattern related to the curled leaf, but without jagged edges.	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 1; Ersari 0; Saryk 0
15	Central channell decorated with goat-cross motif	Four pairs of goat horn designs extended from a diamond	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 1; Saryk 0
16	Central panel decorared with "ashik" motif	A motif probably derived from a geometric rendering of a rosette.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 1; Saryk 0
17	Simple ashik	The motif consists of two halves and and has sharp edges, but is not so jagged	0 = absent 1 = present	Yomut 1; Tekke 0; Salor 0; Ersari 1; Saryk 0
18	Complex ashik	Very jagged, elongated motif	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 0
19	Central panel decorated with *mihrab* design	Vertically ordered shapes similar to mosque mihrab	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 1; Ersari 1; Saryk1
20	Central channell replaced by a panel	The panel is decorated with plant ornaments	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 0; Saryk 1
21	*Alem* panel below field	A rectangular panel below the field decorated with repetitive motifs	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 1
22	*Alem* stars	The panel is decorated ith rows of 8-point stars in a diagonal lattice	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 0; Saryk 0
23	*Alem* animals	The panel features large stylised animals.	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 1; Ersari 0; Saryk 0

24	*Alem* animals as "Great Bird"	Large two-headed bird woven in black pile	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 1; Ersari 0; Saryk 0
25	*Alem* animals as smaller solid motifs	Unspecified creature woven as a "solid" form, filled with colour.	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 0; Saryk 0
26	*Alem* plants	The panel features rows of plant motifs	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 1; Saryk 1
27	*Alem* "ashik"	Rows of displaced "ashik" motifs	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 0
28	*Alem* ashik in boxes	A thin square border separates the motifs	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 0; Saryk 0
29	*Alem* panel above field	A rectangular panel above the field decorated with repetitive motifs	0 = absent 1 = present	Yomut 1; Tekke 0; Salor 0; Ersari 0; Saryk 1
30	*Alem* decorated with "kejebe" pattern	This pattern features a row of ornament resembling mosque mihrabs, which usually feature on prayer rugs.	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 0; Saryk 1
31	Single *mihrab*	A single angular arch reminiscent of prayer rug mosque mihrab interrupts the border above the field.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 0
32	Goat-horn rows	Borders separated by row of goat-horn motifs	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 1; Ersari 1; Saryk 1
33	"S-type" borders	A variety of scrolling borders in S-shapes	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 1; Saryk 1
34	Separated S shapes	White S shapes woven in a geometric style	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 1; Saryk 1

35	Curled leaf	The curled leaf features in the borders of many Turkmen textiles.	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 1; Ersari 0; Saryk 1
36	Scrolling animal tree	Vertically ordered sequence of S-like shapes displacing rows of animal head motifs	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 0; Saryk 1
37	Climbing goat-horn pattern	Vertically orgered sequence of elongated diamonds with goat-horn tips	0 = absent 1 = present	Yomut 1; Tekke 0; Salor 0; Ersari 0; Saryk 1
38	Solid climbing goat horns	The diamonds are designed as cloured blocks	0 = absent 1 = present	Yomut 1; Tekke 0; Salor 0; Ersari 0; Saryk 0
39	Hollow climbing goat-horn pattern	The diamonds are only outlined.	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 0; Saryk 1
40	Climbing plant borders	Wide borders featuring vertically connected plants or flowers	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 1
41	Simple plant	A flower with a central stem, with smaller flowers branching off	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 1; Saryk 1
42	Thorned flower	A large flower with jagged edges and thorny stem	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 0
43	Tulips	Large main flower with smaller blossoming arms.	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 0; Saryk 1
44	Jagged tulips	A large tulip with jagged edges and thorny stem	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 0; Saryk 0
45	Reciprocal goat-horn box border	Columns of boxes featuring a reciprocal goat-horn pattern	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 1; Ersari 1; Saryk 1
46	Reciprocal goat-horn box border version 1	Goat horns ordered horizontally	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 1; Ersari 0; Saryk 0
47	Reciprocal goat-horn box border version 2	Cross-shaped goat horns	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 0; Ersari 1; Saryk 1

48	Diamond border	Diamonds formed by alternately coloured traingles pointing inwards from the edge of the border	0 = absent 1 = present	Yomut 0; Tekke 0; Salor 0; Ersari 1; Saryk 1
49	Rosette motifs	Small rosettes placed between or in the middle of patterns	0 = absent 1 = present	Yomut 0; Tekke 1; Salor 1; Ersari 1; Saryk 1
50	Border wave motif	Wave pattern formed by in blocks of alternating colours	0 = absent 1 = present	Yomut 1; Tekke 1; Salor 0; Ersari 0; Saryk 0

Table B3. Data Matrix for *Ensi* Design Characters

Taxa	Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Bakhtiari	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
2	Yomut	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	1	1
3	Tekke	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	0
4	Salor	1	1	1	0	0	1	1	0	0	1	1	1	0	1	0	0	0
5	Ersari	1	1	1	0	0	1	1	1	0	1	1	0	0	0	1	1	1
6	Saryk	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Taxa	Characters	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	Bakhtiari	1	1	0	0	0	1	0	0	1	1	0	0	0	1	0	1	0
2	Yomut	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0
3	Tekke	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	0
4	Salor	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0
5	Ersari	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1
6	Saryk	0	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	1

Taxa	Characters	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1	Bakhtiari	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0
2	Yomut	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1
3	Tekke	1	1	0	0	0	1	0	1	1	0	1	0	1	0	1	1
4	Salor	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0
5	Ersari	0	0	0	0	0	0	1	0	0	0	1	0	1	1	1	0
6	Saryk	1	1	1	0	1	1	1	0	1	0	1	0	1	1	1	0

APPENDIX C

Kheshti Garden Carpets Designs Data

Table C1. Sample of *kheshti* design carpets from Chahar Mahal va Bakhtiari

	Item	Group/ Location	Source
1	*Kheshti* design carpet	Feridan	Field survey April – July 2002
2	*Kheshti* design carpet	Feridan	Field survey April – July 2002
3	*Kheshti* design carpet	Feridan	Field survey April – July 2002
4	*Kheshti* design carpet	Feridan	Field survey April – July 2002
5	*Kheshti* design carpet	Feridan	Field survey April – July 2002
6	*Kheshti* design carpet	Feridan	Field survey April – July 2002
7	*Kheshti* design carpet	Feridan	Field survey April – July 2002
8	*Kheshti* design carpet	Feridan	Field survey April – July 2002
9	*Kheshti* design carpet	Feridan	Field survey April – July 2002
10	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
11	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
12	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
13	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
14	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
15	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
16	*Kheshti* design carpet	Chehelgerd	Field survey April – July 2002
17	*Kheshti* design carpet	Chehelgerd	Field survey May 2003
18	*Kheshti* design carpet	Chehelgerd	Field survey May 2003
19	*Kheshti* design carpet	Bazoft	Field survey May 2003
20	*Kheshti* design carpet	Bazoft	Field survey May 2003

21	*Kheshti* design carpet	Bazoft	Field survey May 2003
22	*Kheshti* design carpet	Bazoft	Field survey May 2003
23	*Kheshti* design carpet	Bazoft	Field survey May 2003
24	*Kheshti* design carpet	Bazoft	Field survey May 2003
25	*Kheshti* design carpet	Bazoft	Field survey May 2003
26	*Kheshti* design carpet	Bazoft	Field survey May 2003
27	*Kheshti* design carpet	Bazoft	Field survey May 2003
28	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 306**
29	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 309**
30	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 219**
31	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 220**
32	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 221**
33	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 162**
34	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 80**
35	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 152**
36	*Kheshti* design carpet	Chahar Mahal	Willborg 2002 **plate 81**
37	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 115**
38	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 117**
39	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 118**
40	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 244**
41	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 252**
42	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 253**
43	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 255**
44	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 254**
45	*Kheshti* design carpet	Boldaji	Willborg 2002 **plate 137**

46	*Chahar Bagh* carpet	North-west Iran	Ford 1997 **plate 330**
47	*Chahar Bagh* carpet	North-west Iran	Ford 1997 **plate 346**
48	*Chahar Bagh* carpet	North-west Iran	Ford 1997 **plate 347**

Table C2. Kheshti Design Character Descriptions

	Character	Description	States	Distribution
1	"Flower beds"	The field is divided into compartments or "tiles", each of which contains a design.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
2	"Kheshti"	The entire field is decorated with tiles in an all-over design	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
3	Rose	Large rose ornament dominating tile or border, complemented with minor flower motifs.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 0
4	Rose Type 1	Type 1 is a rose or rosette viewed from above.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 0
5	Rose Type 2	Rose viewed from above rendered in a geometric design	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 0
6	Rose Type 3	Type 2 is a profile of the layered petals of a rose bud, represented in circular or semi-circular lines.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 0
7	Shrub	Short, broad plant fanning outward	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
8	Shrub: Naturalistic	A simplified, but recognisable shrub design in curvilinear form	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0: Feridan 0; Chahar Mahali 1; Boldaji 1
9	Shrub: Abstract	A geometric rendering of the shrub design	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
10	Three-Flower Ornament	Three large pink/red blooming flowers connected to a stem.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 0

11	Three-Flower Ornament: Speckled	The design is made up from different coloured blocks to give a speckled effect.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 0
12	Three-Flower Ornament: Rosette	Rosette-style flowers.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 0; Boldaji 0
13	Birds	The tiles feature bird designs	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 0
14	Parrot	Profile of parrot(s) perched in tree branches.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 0
15	Parrot: Border Motif	Smaller, repetitive parrot-in-tree motif used to decorate border.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 0; Boldaji 0
16	Cypress Tree	Distinctive profile of the cypress tree, showing branches and foliage.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
17	Cypress Tree: Single Tree	In some tiles only one tree is represented, used as a central tile ornament.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 1
18	Cypress Tree: Multiple Trees	Two or more smaller tree motifs, usually complemented with flower motifs.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 0; Chahar Mahali 1; Boldaji 1
19	Cypress Tree: Broad Shape	The shape of the tree is broad and relatively short.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 0; Chahar Mahali 0; Boldaji 0
20	Cypress Tree: Narrow Shape	The shape of the tree is tall and narrow.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 1; Boldaji 1
21	Branches	Branching tree/ bush blossoming leaves and/ or rosettes.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
22	Branches: Straight	Branches connected to a central, straight stem or trunk.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1

23	Branches: Oblique	Branches, leaves and flowers connected to an oblique stem stretching from corner to corner of the tile.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 0
24	Branches: Leaves	Leafy branches	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 0; Chahar Mahali 1; Boldaji 0
25	Branches: Flowers	Branches in blossom, with flowers blooming.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
26	Weeping Willow	Distinctive profile of the weeping willow tree, represented in varying levels of abstraction.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
27	Weeping Willow: Naturalistic	Several layers of drooping branches connected at the top of the trunk.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 0
28	Weeping Willow: Abstract (Type 1)	Symbolic tree in which 2 columns of branches on either side of a "trunk" to which they are not connected.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 0; Chahar Mahali 1; Boldaji 1
29	Weeping Willow: Abstract (Type 2)	Motif apparently based on the weeping willow design, reduced to herring-bone style symbol.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 0; Chahar Mahali 0; Boldaji 1
30	Flower Ornament	A large flower connected to 4 smaller flowers in each corner of the tile.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 0; Boldaji 0
31	Flower Ornament: Additions	2 additional small rosettes connected to the central ornament.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 0; Boldaji 0
32	Flower Bed	Many small flowers and rosettes filling the entire tile.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 1; Chahar Mahali 0; Boldaji 1
33	Flower Bed: Stems	Small flowers connected by stems.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 1; Chahar Mahali 0; Boldaji 0
34	Flower Bed: No stems	The flowers are not connected.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 0; Boldaji 1

35	Flower Bed: Middle Space	In the centre of the tiles the flowers are parted into an empty space.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 0; Chahar Mahali 0; Boldaji 1
36	Boteh	Boteh ornaments	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
37	Boteh: Small	Small, smooth edged boteh motifs.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 0; Chahar Mahali 0; Boldaji 1
38	Boteh: Large	Large, stepped edged boteh motifs.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 0; Chahar Mahali 1; Boldaji 1
39	Mihrab	An archway remiscent of a mosque niche decorated with flora.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
40	Mihrab: Flowers	Flowers underneath the arch.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 0; Boldaji 1
41	Mihrab: Plant	Suggestion of ivy or a climbing plant running parallel to the archway.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 0; Chahar Mahali 1; Boldaji 0
42	"Ashik"	Layered polygon, with stepped outer edge and flowers in the central ornament.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
43	Ashik: Rosettes	Central ornament of gol decorated with three rosettes	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 1; Chahar Mahali 1; Boldaji 1
44	Ashik: Single Flower	Central ornament of gol decorated with a single flower.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 1; Chahar Mahali 0; Boldaji 1
45	Layered Tree	A large thick trunk connects several layers of leafy branches that fan out.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 0; Chahar Mahali 1; Boldaji 1
46	Mahi Border	Mahi design: jagged comb-like motif intersected with rosettes.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 0; Chahar Mahali 1; Boldaji 1
47	Mahi Border: Straight Combs	Comb motifs short and straight	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 0; Feridan 0; Chahar Mahali 1; Boldaji 1

48	Mahi Border: Diagonal Combs	Longer, diagonal comb motifs.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 0; Feridan 0; Chahar Mahali 1; Boldaji 1
49	Stylised Bare Branches	V-shaped branches joined to a trunk, with the suggestion of twigs.	0 = Absent 1 = Present	Chehelgerd 1; Bazoft 1; Feridan 0; Chahar Mahali 0; Boldaji 0
50	Flower Vase	Small sharp-edged flowers in a vase.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 0; Chahar Mahali 1; Boldaji 0
51	Two Flower Plants	Climbing flower plants on either side of the tile with flowers in between.	0 = Absent 1 = Present	Chehelgerd 0; Bazoft 1; Feridan 0; Chahar Mahali 1; Boldaji 0

Table C3. Data Matrix for *kheshti* design characters

Taxa	Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	NW Iran (OG)	1	0	1	1	0	0	1	1	0	1	0	1	1	0	0	1	1
2	Chehelgerd	1	1	1	1	0	0	1	0	1	0	0	0	1	0	0	1	1
3	Bazoft	1	1	0	0	0	0	1	0	1	1	1	1	0	0	0	1	0
4	Feridan	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
5	Chahar_Mahal	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
6	Boldaji	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1

Taxa	Characters	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	NW Iran (OG)	0	0	1	1	0	1	1	1	0	0	0	0	1	0	1	1	0
2	Chehelgerd	0	1	0	1	0	0	1	1	1	0	1	0	1	0	1	1	0
3	Bazoft	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0
4	Feridan	0	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1
5	Chahar_Mahal	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
6	Boldaji	1	0	1	1	1	1	0	1	1	0	1	1	0	0	1	0	1

Taxa	Characters	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1	NW Iran (OG)	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0
2	Chehelgerd	1	1	1	0	1	1	0	1	0	0	0	1	1	0	1	0	0
3	Bazoft	1	0	0	1	1	1	0	1	1	0	0	0	0	0	1	1	1
4	Feridan	1	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0
5	Chahar_Mahal	1	0	0	1	1	0	1	1	1	0	1	1	1	1	0	1	1
6	Boldaji	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0